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FURUNO

OPERATOR'S MANUAL

GPS NAVIGATOR

MODEL GP-500

FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

(9212,shni)
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INTRODUCTION

Congratulation on your choice of the Furuno GP-500 GPS Navigator. We are confident that you will enjoy many years of operation with this fine piece of equipment.

For over 40 years Furuno Electric Company has enjoyed an enviable reputation for quality and reliability throughout the world. This dedication to excellence is furthered by our extensive global network of agents and dealers.

The GP-500 Navigator is the culmination of a long line of Furuno developments in the field of navigation. In one compact cabinet is virtually all the navigation capabilities most voyagers will ever need.

A word about the organization of this manual: it is laid out in as "user-friendly" a manner as possible. We realize that a sophisticated instrument such as this, with its many, many functions can be very intimidating to the first-time user. It is our intention to guide the user along in the use of the gear as gently and as comfortably as possible in a series of sections that start at a very basic level and proceed forward in complexity in a logical manner.

We would appreciate feedback from you, the end-user, about whether we are achieving our purposes in this manual.

Thank you for considering and purchasing Furuno equipment.

CAUTION

Although your GPS Navigator is capable of providing very accurate position data, no single navigational device should ever be solely relied upon. Position information obtained from GPS should always be double-checked against other sources such as radar, visual and celestial sightings, sounding measurements, etc. to verify the reliability of the data.

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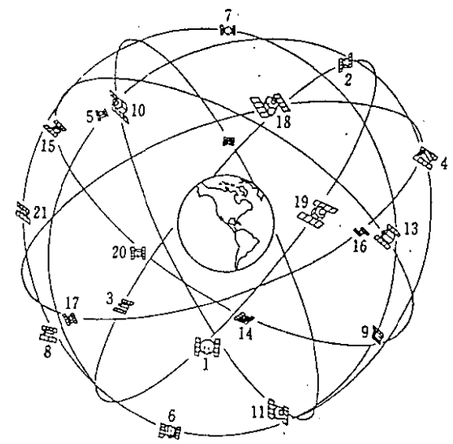
INTRODUCTION

Principle of GPS

GPS is an acronym meaning Global Positioning System. The Global Positioning System, also known as NAVSTAR, is a precise satellite navigation system developed by the U.S. Department of Defense.

When full global coverage becomes available, a constellation of 24 satellites (including 3 spares) emplaced in nearly 20,000-kilometer high 12-hour circular orbits will provide highly precise, continuous, worldwide, all-weather position plus time and velocity information to user-equipped land vehicles, marine vessels, and aircraft.



Unlike the conventional navaid, GPS offers 3-dimensional position-fixing. Thus, it can be utilized not only on surface boats/vehicles but also on aircraft. 3-dimensional position-fixing requires four satellites in lines of sight, while 2-dimensional position-fixing requires only three. At the present stage, where a limited number of satellites ate in orbit, 2-dimensional position-fixing is preferable for surface boats/vehicles. This is because the possibility of having 3 satellites simultaneously is higher than 4-satellite possibility, i.e., you can expect GPS fix for longer periods every day.

GPS vs. TRANSIT & LORAN-C

Many people surmise that GPS is similar to TRANSIT since the position is fixed by using satellites. However, as detailed in the following table, it is quite different from TRANSIT, but is rather similar to LORAN-C. (It might be called "Loran chains in the sky.")

GPS	TRANSIT(satnav)	LORAN-C
Position is fixed by receiving 3 (or 4) satellites in line of sight.	Position is fixed by receivcing only one satellite.	Position is fixed by receiving 3 stations (= 1 master +2 slaves).
Position can be fixed continually while 3 (or 4) satellites are in line of sight.	Position is fixed one time only when a satellite comes in line of sight.	Position can be fixed continually while the ship is in the loran chain coverage.

However, note should be taken that GPS fix is obtainable by receiving any 3 (or 4) satellites. There is no specific combination requirement unlike LORAN-C where the master and slave combination is fixed.

How GPS fix is obtained

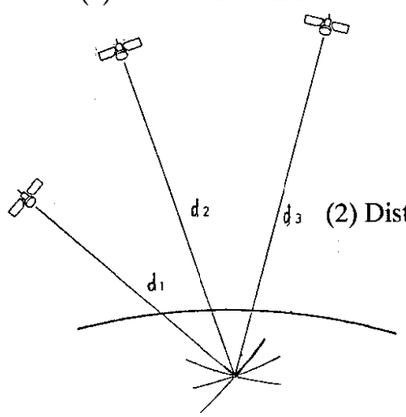
As mentioned earlier, GPS satellites are not geostationary. They are orbiting the earth as illustrated on the preceding page. Position is repeatedly fixed through the following three steps while any 3 (or 4) satellites are in line of sight.

(1) GPS satellites continually transmit their own precise orbital data (called "ephemeris"). The GPS receiver computes their locations by receiving these data.

(2) In the above-mentioned receiving process, the GPS receiver measures very accurate distances to the satellites, using what is known as "spread spectrum modulation." Excellence in GPS's position-fixing accuracy is mainly due to this technology.

(3) Satellite locations and their distances are known already. Now the GPS receiver fixes its own position by triangulation.

(1) Satellite locations are calculated.

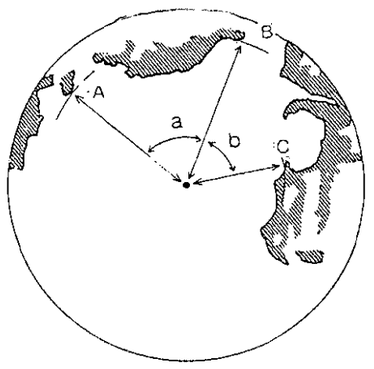


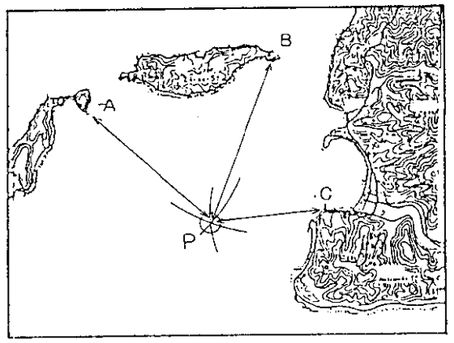
(2) Distances are measured.

(3) GPS fix is calculated as the meeting point of three spheres which are drawn around the three satellites with diameters, d1, d2, and d3.

Position-fixing Accuracy (HDOP) and Back-up Navaid

As you may have noticed, GPS fix is obtained in the same manner as the position-fixing which is conducted on the radar by using the VRM (variable range marker). The following figures show a radar screen and sea chart. A, B and C are known locations (lighthouse, cape, etc.), and the distances to those targets are measured on the radar screen by using the VRM. The own ship location is fixed as the intersection of three circles which are drawn with the diameters of VRM readouts, centering around A, B and C. (In case of GPS, A, B and C correspond to satellites.)

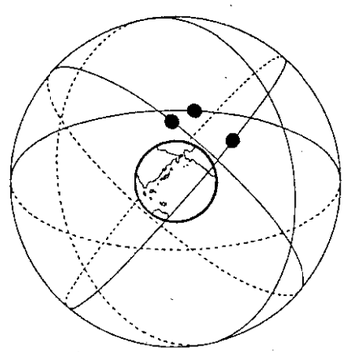


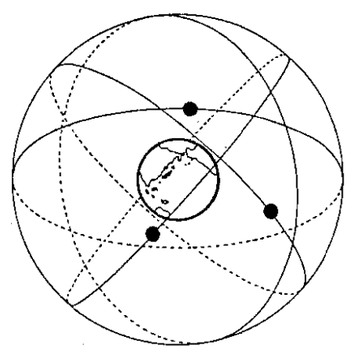


As experienced navigators know, high accuracy can be expected when the targets are spaced nearly 90 degrees approx. from each other.

Similarly, GPS fix accuracy is subject to the locations of 3 (or 4) satellites in the sky. Roughly speaking, high accuracy is obtainable when the satellites are widely scattered in the sky; on the contrary, accuracy is reduced when the satellites have gathered in a narrow space (angle).

See the figures below. In both cases GPS fix is obtainable in Tokyo since 3 satellites are in line of sight. However, accuracy in the right case will be higher than the left because 3 satellites are located in three different (apart) locations.

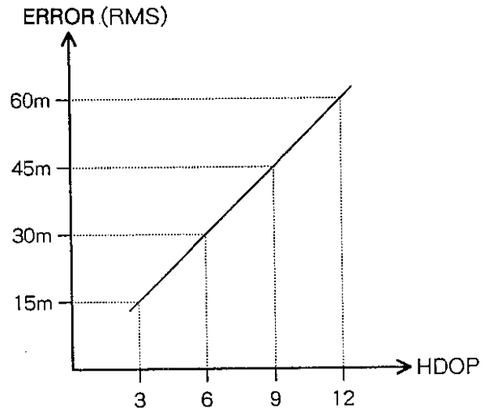




As the index for position-fixing accuracy, HDOP (Horizontal Dilution of Precision) is widely used. The smaller the HDOP value, the more accurately position can be fixed. For instance, HDOP of 3 to 5 are considered desirable, but values above 10 represent poor GPS fix accuracy. While each satellite is revolving in a different direction, the geometrical relationship among 3 (or 4) satellites e.g. HDOP value changes as time elapses.

You may register a HDOP Threshold value in the GP-500. While the HDOP of existing satellites is lower (better) than the threshold, GPS fix is presented on GP-500. When the HDOP becomes worse than the threshold, the external navaid fix is presented, or estimated lat/long are computed/presented by using the speed/heading data sent from the speed log/gyro. The external navaid or position-estimating (dead-reckoning) by speed/heading is called BACK-UP NAVAID.

Error in distance is proportional to the HDOP value as shown below.



NOTE 1. The error shown above is observed on the GP-500 under favorable receiving condition.

2. GPS system accuracy is under control of the US Government. The error shown above is subject to change, depending on it.

GPS Satellite Arrival Time & Almanac

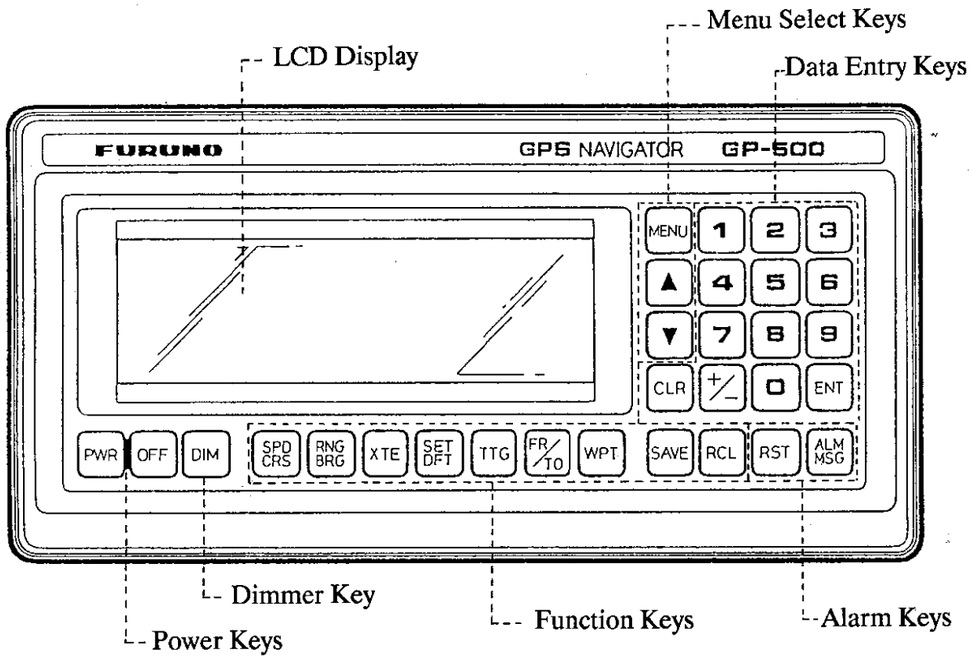
Until the full complement of GPS satellites is launched, it is important to note that limited hours of position-fixing is available. The period and time differ with respect to geographical location on the earth.

The time required for a GPS satellite to revolve round the earth is 11 hours and 58 minutes. This means that the predicted satellite arrival time in a given area will be 4 minutes earlier each succeeding day. (4 min. per day, half an hour per week, 2 hours per month and whole a day per year). For example, supposing that the satellite arrival time was 3:00 to 5:00 PM today, the same satellite will be in line of sight from 2:56 to 4:56 PM tomorrow. The hours of position-fixing also advances 4 minutes a day.

Every satellite is broadcasting not only its own orbital data (ephemeris explained on page 2) but also rough orbital data of all the GPS satellites, called the Almanac. Therefore, the GP-500 can predict arrival times of all the GPS satellites by receiving a single satellite. The GP-500 acquires/receives GPS satellites in accordance with this prediction. Unless the Almanac is available in the GP-500, position-fixing is not initiated. As the GP-500 is shipped from the factory with the Almanac memorized, you may use it immediately after installation. Whenever the GP-500 receives a satellite, the Almanac is replaced.

BASIC OPERATIONS

Power-on/off & Data Entry Procedures



POWER & DIMMER Key Usages

Press the [PWR] key. ----------> The GP-500 is turned on.
Press the [PWR] and [OFF] keys simultaneously. ----------> The GP-500 is turned off.

Every hit of the [DIM] key adjusts the LCD and keyboard backlight in four levels including OFF.

Key depression acknowledging pip

A pip is generated at every key depression.

When an illegal key depression is detected, the pip is generated twice (pip-pip). Press a correct key.

Data Entry Procedure

This section offers a sample operation to familialize yourself with how to enter data into the GP-500. Try punching in data as you read through it. The keys used for data entry are:

[0] [1] [2] --- [9]

Numeric Keys

[+/–]

Changes polarity of numeric value and lat/long data. (+ ⇔ –, N ⇔ S, E ⇔ W)

[CLR]

Before entering a new data, clear the existing one by pressing this key. Also, press this key when you have pressed a wrong numeric key.

[ENT]

After having written a data on the screen by using the above keys, press [ENT] last. The data is stored internally.

SAMPLE OPERATION

Turn the power on, and then press the [MENU] key to present the MENU screen.

```
MENU
SELECT NUMBER : 0~9
 0:INITIAL DATA(1)      5:ROUTE
 1:TIMER                6:ALARM
 2:TIMER SET            7:FUTURE SATELLITE
 3:WAYPOINT             8:
 4:VOYAGE PLAN          9:SYSTEM DATA
```

Item No. Item No.

Select any item by pressing a numeric key. In this sample operation, press [0] to select INITIAL DATA (1). The screen should look something like the figure at the top of the next page.

```
  I N I T   D A T A  ( 1 )
→DATE   (M/D/Y)      =  02/30/1991819
 TIME                =  13 : 25' 00" J
 LOCAL  ZONE  TIME = +09H00M
 LAT                 =  34° 44. 00' N
 LONG                = 135° 21. 00' E
 HDOP  THRESHOLD  =  05 (01~99)
```

Arrow ⇒ indicates the line in which you may enter a new data.

By pressing the [Δ] and [∇] keys, move arrow ⇒ onto any line. In this sample operation, press the [∇] key three times in order to move the arrow to the "LAT" line.

```
  I N I T   D A T A  ( 1 )
 DATE   (M/D/Y)      =  02/30/1991819
 TIME                =  13 : 25' 00" J
 LOCAL  ZONE  TIME = +09H00M
→LAT                 =  34° 44. 00' N
 LONG                = 135° 21. 00' E
 HDOP  THRESHOLD  =  05 (01~99)
```

Now the arrow is here.

Enter a latitude by pressing the data entry keys. In this sample operation, press the keys in the following sequence in order to enter 5°21.34'S.

[CLR] [0] [5] [2] [1] [3] [4] [+/–] [ENT]

5° 21.34'

Every hit of this key selects North(N) and South(S) alternately. Call up "S" on the prompt line by pressing this key.

NOTE: 1. Arrow ⇒ starts and stops blinking when [CLR] and [ENT] are pressed respectively.

2. Leading zeroes can not be omitted.

```
  I N I T   D A T A  ( 1 )
 DATE   (M/D/Y)      =  02/30/1991819
 TIME                =  13 : 25' 00" J
 LOCAL  ZONE  TIME = +09H00M
→LAT                 =  05° 21. 34' S <---
 LONG                = 135° 21. 00' E
 HDOP  THRESHOLD  =  05 (01~99)
```

New data has been entered!

You may repeat data-entering operation in the same manner as above; i.e., after moving arrow ⇒ to any line by pressing [Δ] or [∇], enter a new data by using the data entry keys.

When data entry operation is over, recall the previous screen by pressing the function keys shown on page 6.

NOTE: Daily used functions may be called up directly by pressing the function keys. The [MENU] key is mainly used for after-installation parameter setting.

To turn off the power, press the [PWR] and [OFF] key simultaneously.

Daily Start-up Procedure

NOTE: When the unit is installed, the PARAMETER SETTING described on page M-8 must be done. For daily operations, you would begin here.

Press the [PWR] key. ----------> The GP-500 starts operation.

- If "BACK UP DATA ERROR!" is presented, see page 45.
- Immediately after turning on the power, "PF" (Power Failure) appears on the bottom-right corner of the screen, but disregard it. It will disappear upon pressing a key.

↓

INITIAL LAT/LONG Entry

Usually this operation is not required. If the PRESENT POSITION reading is extremely (more than 10 degrees for example) different from actual position, however, enter estimated lat/long as follows.

```
12° 34.567' N
123° 45.678' E
```

Press [MENU] and [0] in this order.

↓

[▽]

[▽]

[▽]

```
INIT DATA (1)
→DATE (M/D/Y)      = 01/30/1918
 TIME              = 13:25'00" J
 LOCAL ZONE TIME = +09H 00M
 LAT               = 34° 47.000' N
 LONG              = 135° 25.000' E
 HDOP THRESHOLD    = 05 (01~99)
```

[CLR] [ ][ ]° [ ][ ].[ ][ ]' ([+/–]) [ENT] ---------- Enter estimated LATitude of the present position with the accuracy better than 10 degrees.

deg. min. Select N or S.

[▽]

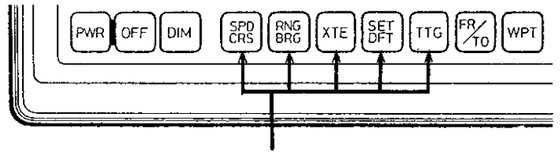
[CLR] [ ][ ][ ]° [ ][ ].[ ][ ]' ([+/–]) [ENT] --------- Enter estimated LONGitude of the present position with the accuracy better than 10 degrees.

deg. min. Select E or W.

↓

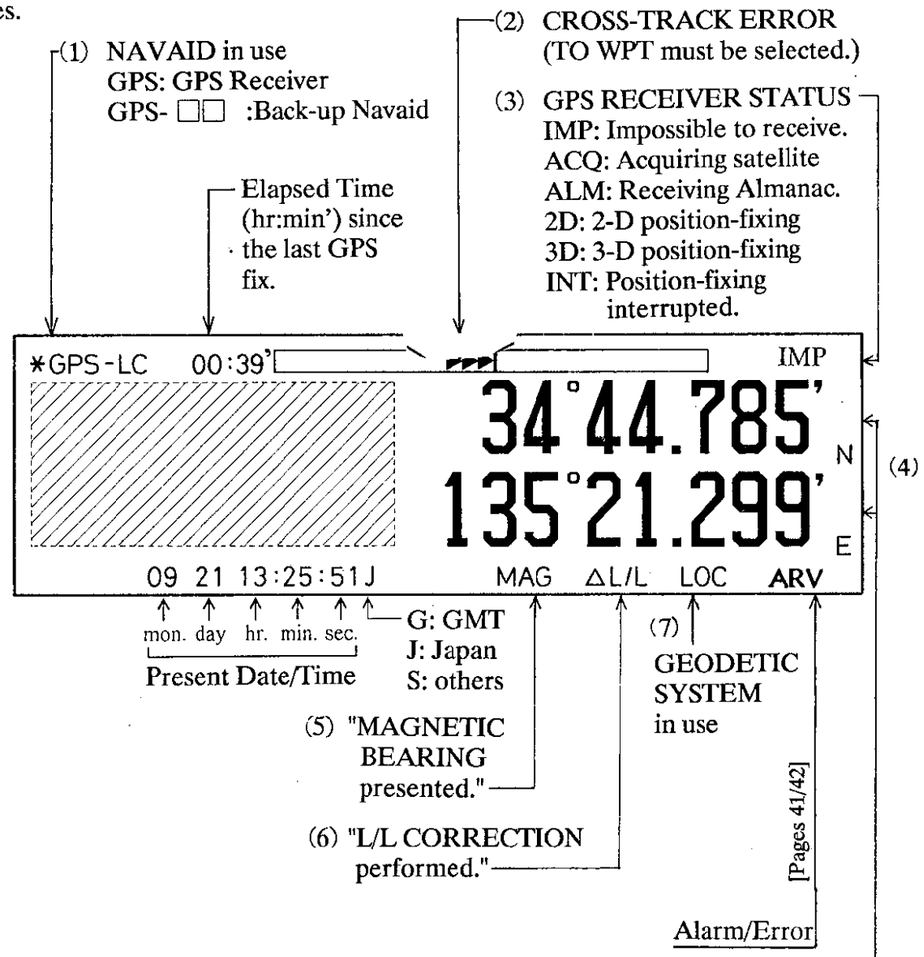
Now, you may do any operation you want, such as the following one.

POSITION DATA Presentation



BASIC

Press any one of the five keys, and various data are presented as illustrated below. Presentation on the hatched area differs with respect to the function key pressed, but the other area is common. The items numbered (1) thru (7) in the illustration are explained on the succeeding pages.



PRESENT POSITION

If a constant error is observed in the lat or long reading, it may be offset. See LAT/LONG CORRECTION on page M-11.

The readings may be stabilized. See L/L SMOOTHING on page M-11.

(1) NAVAID in use

Indication	Navaid in use
GPS	Position-fixing by GPS. (A pip is generated three times when GPS fix becomes available or unavailable. This function can be cancelled. [Page M-12])
GPS-A	Dead-reckoning (position-estimating) by LOG/GYRO.
GPS-M	Dead-reckoning (position-estimating) by using the speed and heading data which are entered through the keyboard manually. [Page M-22]
*GPS-DR	Back-up by external SATNAV (TRANSIT)
*GPS-LC	Back-up by external LORAN-C
*GPS-LA	Back-up by external LORAN-A
*GPS-OM	Back-up by external OMEGA
*GPS-DC	Back-up by external DECCA
---	None (If a backup navaid is not available, GPS position fixing is performed even when the HDOP is inferior to the HDOP threshold. "---" appears in this case, too.)

If GPS POSITION CORRECTION [page M-20] is performed, * is not attached.
Ex. "GPS-LC"

(2) CROSS-TRACK ERROR [page 28]

Number of ◄ or ► increases up to 10 points in accordance with the cross-track error mileage. One point of arrow equals to 0.02nm.

Instead of cross track error, course error (Direction difference between bearing to TO WP and ship's heading.) can be displayed. One point of arrow mark equals to 3 degrees.

To return your boat to the intended track line or proper course, steer the helm in the direction indicated by the arrows.

Presentation may be turned off. See page M-19.

(3) GPS RECEIVER STATUS

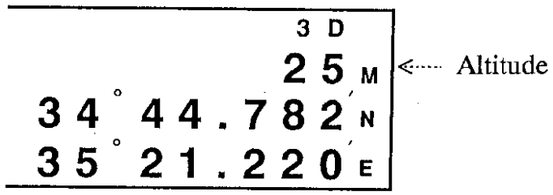
Ind.	Status
C-ST	COLD START (This is a special start-up condition.) The GP-500 was turned on without Almanac inside. The GP-500 immediately starts acquiring a satellite in order to receive Almanac. If you know what satellite is available in line of sight, conduct the COLD START operation described on page M-6.
IMP	IMPOSSIBLE to receive. According to the Almanac, a satellite is not available in line of sight.

BASIC BASIC

ACQ	ACQUIRING a satellite. According to the Almanac, a satellite is available in line of sight, and the GP-500 is acquiring it, but have not received it yet. If the ACQ state lasts a long time without changing to ALM, 2-D, or 3-D below, suspect that satellite signal is not received normally.
ALM	Receiving ALMANAC. According to the Almanac in the GP-500, 3 satellites (4 satellites in case of the 3-D mode) are not yet available in line of sight. Since position-fixing can not be done, the GP-500 is receiving Almanac.
2-D or 3-D	2-DIMENSIONAL or 3-DIMENSIONAL position-fixing. When a back-up navaid is available; According to the Almanac, HDOP is superior to the HDOP threshold. After having acquired the satellites, the GP-500 is performing position-fixing operation while receiving them. When a back-up navaid is not available; 2-D or 3-D position fixing is performed regardless of HDOP so long as 3 or 4 satellites are available.
INT	Position-fixing INTERRUPTed. Reception is interrupted due to objects around the GPS antenna, etc. According to the Almanac, HDOP is still superior to the HDOP threshold. When the lost satellite reappears, 2-D or 3-D position-fixing will be resumed.

(4) PRESENT POSITION

The Latitude/Longitude are presented with 0.01 or 0.001 minute resolution depending on the setting on page M-19. In case of 3-D mode position-fixing (page M-12), the antenna altitude above the sea level is additionally presented.



(5) MAGNETIC VARIATION CORRECTION [page M-17]

When this correction is performed, "MAG" is presented to inform you that all the bearings presented on the GP-500 are magnetic ones. If "MAG" is absent, all the bearings are true.

(6) LAT/LONG CORRECTION [page M-10]

When this correction is performed, " △ L/L" appears. Only GPS fix is corrected.

(7) GEODETIC SYSTEM in use [page M-13]

"LOC" (local) is presented if a geodetic system other than WGS-84 is selected.

NAV. DATA Presentation

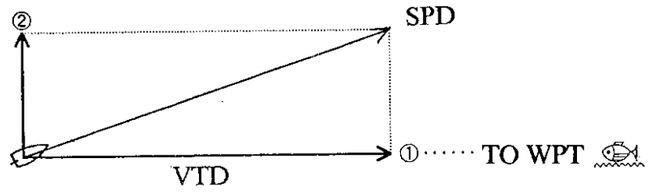
See the illustration on page 11. Presentation in the hatched area differs with respect to the function key pressed as described below.

NOTE: The items with asterisks (*) in the following descriptions are presented when a TO WAYPOINT is selected. Unless you are familiar with waypoint navigation, read the next chapter first.

Press [SPD • CRS].

VTD	:	12.3 KT	<---- * Velocity To Destination
SPD	:	12.5 KT	<---- Speed
CRS	:	168.2 °	<---- Course

When the course (ship's moving direction) is deviated from the TO WAYPOINT, the speed can be broken into two components, ① and ② shown below.



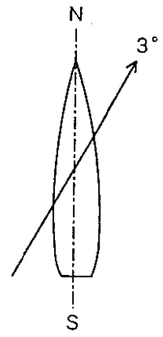
The speed component in the TO WPT direction, e.g., 1 is called Velocity To Destination or VTD. Component 2 increases the cross-track error only.

NOTE 1. When the ship is leaving the TO WAYPOINT, a negative speed is presented as VTD. Instead of VTD, range or bearing to TO WP can be displayed.

2. During GPS position-fixing, the speed (SPD) and course (CRS) are directly measured by receiving satellite signal. Bear in mind that the readings are not calculated from the change of lat/long.

3. The speed (SPD) and course (CRS) discussed here are true ones, and they differ from the water-tracking speed and heading which are typically measured by using a speed log and a compass, respectively. See the example on the next page; the ship's heading is due North, but the ship's moving direction is deviated to 3° by the sea current. In this case the heading is 0° but the course is 3°.

BASIC



4. During the back-up mode operation, the speed and course information sent from the external navaid are presented. If dead-reckoning is selected as a back-up navaid, the speed and heading information which is fed from the log/gyro or entered manually through the keyboard are presented.

5. As the ship's speed slows down, the course reading will become unstable. This is because a minute error in speed measurement can easily change the course by 180 degrees. The equipment is not faulty.

6. The readings may be stabilized. See S/C SMOOTHING on page M-11.

Press [RNG•BRG].

WPT	:	14→15	<---- * FROM WAYPOINT → TO WAYPOINT
RNG	:	12.57 NM	<---- * Range } of TO WPT observed
BRG	:	168.2 °	<---- * Bearing } from PRESENT POSITION

NOTE: 1. If a TO WAYPOINT is selected without specifying a FROM WAYPOINT, it is presented as shown below.

WPT: 15 (TOKYO)
└ COMMENT

2. In case of routing navigation, a route segment is presented as shown below.

RTE: 14→15
└ After departing WPT 14, the ship is presently heading for WPT 15.

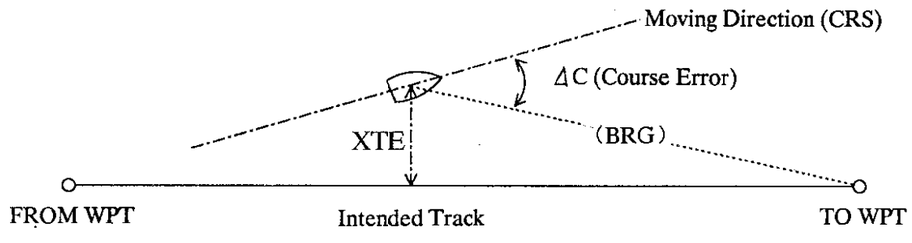
Press [XTE].

WPT	:	1 4 → 1 5	⟵ * FROM WAYPOINT → TO WAYPOINT
XTE	:	1 2 . 5 8 NM	⟵ * Cross-track Error
△C	:	6 8 . 2 °	⟵ * Course Error

A straight line connecting the FROM and TO WAYPOINTS is called a TRACK. It could just as well be termed the INTENDED TRACK because although it is the user's intention to follow this track line faithfully, in reality, he never can do so perfectly due to wind, current, etc.

The amount which the boat is thrown off the intended track is termed the CROSS-TRACK ERROR, and is digitally read as illustrated above. The cross-track error is also presented graphically at the top of the screen.

The ship's moving direction easily deviates from the TO WAYPOINT direction due to waves, current, etc. This deviation angle is called COURSE ERROR. Note that the course error is the difference between the CRS (course) and BRG (bearing) which are presented by pressing [SPD, CRS] and [RNG BRG], respectively.



Press [SET· DFT]

LOG	:	14.8 KT	⟵ Water-tracking Speed
GYRO	:	72.5 °	⟵ Heading
DFT	:	2 . 5 KT	⟵ Speed
SET	:	6 8 . 2 °	⟵ Bearing (of Sea Current)

During GPS position-fixing, true velocity (speed/course) is measured. Apparent velocity information (water-tracking speed/heading) is fed from the log/gyro. The drift/set are calculated as the difference between the true and apparent velocities.

BASIC BASIC

NOTE: 1. As a source of water-tracking speed information, you may select one among the following three; (1) log/gyro, (2) manually entered speed/heading data, and (3) NMEA #0183 data from an external navaid. Details are available on page M-22.

2. The drift/set presentation is available during GPS position-fixing period only.

3 As described earlier, the course reading becomes unstable as the ship's speed slows down. The set reading also becomes unstable because it is calculated, using the course data.

4. The DFT and SET reading may be stabilized. See SET/DRIFT SMOOTHING on page M-24.

Press [TTG].

WPT	:	1 4 → 1 5	⟵ * FROM WPT → TO WPT
TTG	:	00D 1 9 H 0 2 M	⟵ * TIME TO GO to TO WPT (day hr min) is calculated as follows.
ETA	:	12 0 8 : 2 6	⟵ (TTG) = (RNG) ÷ (VTD)

Velocity To Destination

Range to TO WPT

* Estimated Time of Arrival (day hr:min) at TO WPT is calculated as follows.

(ETA) = (PRESENT TIME) + (TTG)

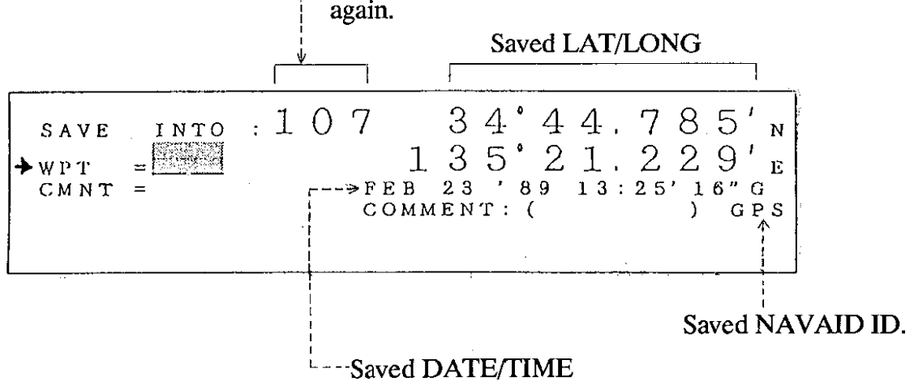
Handling EVENT MEMORIES

Saving EVENT POSITIONS

You may want to make a note of present lat/long when, for example, a wreckage is recorded on an echosounder. This can be done by simply pressing the [SAVE] key.

Press [SAVE].

EVENT No. counts up when [SAVE] is pressed. Position data are stored in event memories, No.100 thru 119, on a round robin basis. After the memories have been written up to No.119, next event positions are stored from No.100 again.

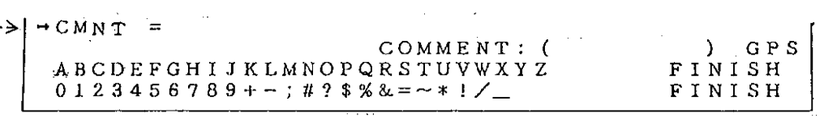


If you want to register the event position as a WAYPOINT;

[ ] [ ] [ENT] ----- Enter a waypoint number. (01 ~ 99)

If you want to enter a COMMENT (max. 8 characters)

[▽] --->



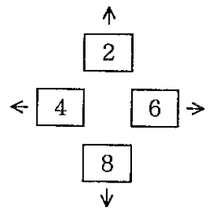
These jobs may be done later on page 19, calling up the event memory.

How to enter a COMMENT

See the alpha-numerics presented on the bottom of the screen. You may select characters one after another by moving the highlight cursor on this presentation.

(1) Press [CLR]. ----------> A highlight cursor appears on character "A".

(2) The following numeric keys also serve as cursor-move keys. By pressing these keys, move the cursor onto the character which you want to enter.



Initially the cursor is on "A." In this sample operation, press [6] (→) four times in order to enter "E." Now, the cursor should be on "E" as illustrated below.

ABCD[E]FGHIJKLMNOPQRSTUVWXYZ

NOTE: The following figure illustrates whole of the characters which can be entered, but only one part is visible on the screen. In order to scroll up or down the presentation on the screen, press [2] (↑) or [8] (↓) repeatedly.

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ                FINISH
0123456789+−;#?$%&=~*!/_                  FINISH
アイウエオカキクケコサシスセソタチツテトナニヌネノハヒフヘホ  FINISH
マミムメモヤユヨラリルレロワヲン゛゜ァィゥェォャュョッ      FINISH
```

(3) Press [ENT], and you will see the cursor-pointed character entered in the prompt line as shown below.

⇒ CMT = E
└--- Entered!

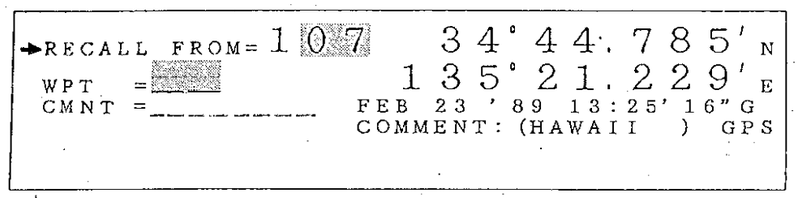
Repeat steps (2) and (3) to complete the comment. When you have entered a wrong character, do the operation from (1) again.

(4) Finally move the cursor onto "FINISH" by pressing [6] (→), then press [ENT], and the comment is entered internally.

Recalling EVENT POSITIONS

Saved event positions may be called up on the screen by hitting [RCL].

The latest event position is presented as illustrated at the top of the next page.



You may call up any event position by the following two methods;

[Method 1] Repeatedly press [RCL] until a desired event position comes up. (Every hit of [RCL] calls up the next latest event position.)

[Method 2] You may randomly call up any event position by entering its EVENT NUMBER:

[CLR] [ ] [ ] [ENT] ------- Enter the lowest 2 digits of the event number. (100 ~ 119)

[▽]

Registering the event position as a WAYPOINT

[ ] [ ] [ENT] ----- Enter WPT No. (01 ~ 99)

[▽]

You may enter a COMMENT as explained on page 18.

NOTE: If a waypoint number is entered above, this comment is also entered in the waypoint memory automatically.

[▽]

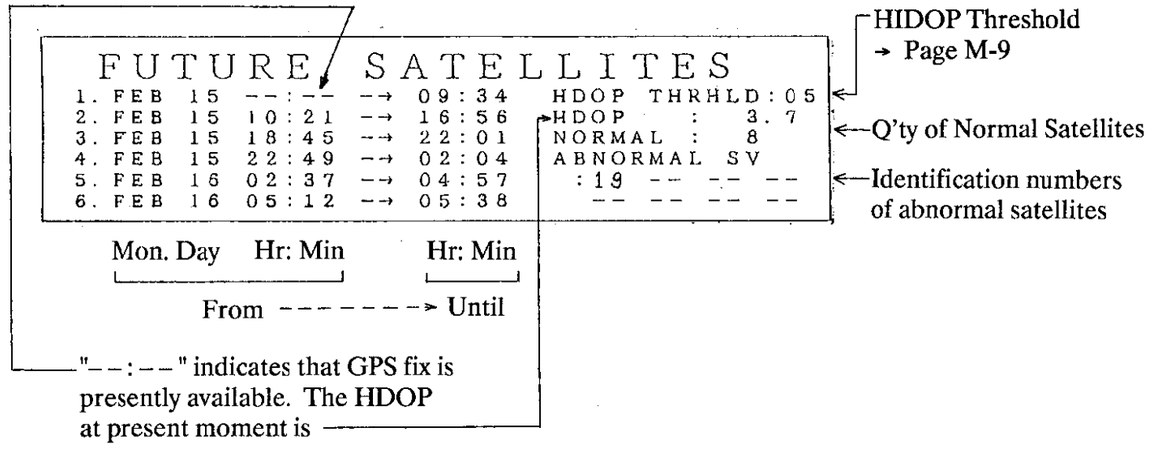
for another event position

BASIC

Presenting FUTURE POSITION-FIXING SCHEDULE

Press [MENU] and [7] in this order.

GPS position-fixing schedule is predicted as illustrated below.


FUTURE SATELLITES
1. FEB 15 --:-- → 09:34
2. FEB 15 10:21 → 16:56
3. FEB 15 18:45 → 22:01
4. FEB 15 22:49 → 02:04
5. FEB 16 02:37 → 04:57
6. FEB 16 05:12 → 05:38
HDOP THRHLD:05
HDOP : 3.7
NORMAL : 8
ABNORMAL SV
:19 -- -- --
-- -- -- --
HIDOP Threshold → Page M-9
Q'ty of Normal Satellites
Identification numbers of abnormal satellites
Mon. Day Hr: Min
Hr: Min
From --------→ Until
"--:--" indicates that GPS fix is presently available. The HDOP at present moment is

NOTE: 1. Prediction is made based on the Almanac. The lower (more strict) the HDOP threshold setting, the shorter are the position-fixing periods.

2. Max. six periods within 24 hours can be presented.

3. Each position-fixing period advances about 4 minutes a day.

4. During GPS position-fixing, the presentation is updated every 15 minutes approx. If the LAT/LONG or HDOP THRESHOLD (page M-9) is entered when GPS position-fixing not performed, the presentation will be updated 3 to 4 minutes later.

HANDLING WAYPOINTS

In navigational terminology, a particular location is known as a WAYPOINT whether it be a starting point, a destination, or an intermediate point on a voyage. You may register in the GP-500 up to 100 waypoints, and may select one as a starting point and another as a destination.

Registering WAYPOINTS

NOTE: The memory contents are preserved internally when the power is shut down or failed. However, it is a good idea to record waypoints in a log just in case.

Registering by LAT/LONG

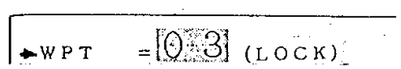
For example, you may register a good fishing ground as a waypoint, of which the lat/long you heard from a partner ship, etc.

[WPT]

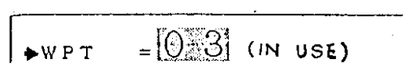
[CLR] [ ] [ ] [ENT] ------- Enter a WPT (waypoint) number.

If caution "LOCK" or "IN USE" is presented as illustrated below;

Unless a caution appears;



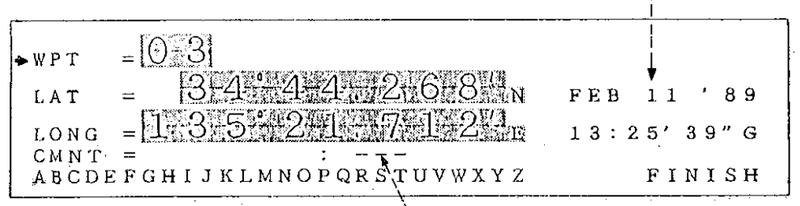
This waypoint is write-protected. If you want to overwrite it, the protection can be removed as described later on.



This waypoint is presently selected as TO or FROM WAYPOINT in the waypoint navigation or routing navigation. If you want to overwrite it, confirm unimportance before doing so.

Date/time of Registration

for another registration



[▽]

[CLR] [ ] [ ]° [ ] [ ].[ ] [ ] [ ]' ([+/–]) [ENT] -------- Enter a LATitude.
deg. min. └─ N/S

[▽]

[CLR] [ ] [ ] [ ]° [ ] [ ].[ ] [ ] [ ]' ([+/–]) [ENT] ---- Enter a LONGitude.
deg. min. └─E/W

[▽]

You may enter a COMMENT as explained on page 18.

[▽]

How to enable/disable LOCK (Write Protection)

After registering an important waypoint, you may protect it from accidental writeover;

Press [▽] or [△] to move arrow ⇒ onto the top line.

Repeat

[CLR] [ ] [ ] [+/–] [ENT] ------- Enter a WPT number.

└── At every press of this key, "LOCK" appears and disappears alternately. To enable (disable) write-protection, call up (erase) "LOCK."

Registering by RANGE/BEARING

You may register a waypoint by range/bearing observed from a known point (waypoint or lat/long).

[MENU] [3] [2]

```
R/B TO WAYPOINT
→FROM WPT      = [ ]  (00~99)
  LAT/LONG=  [ ]° [ ][ ].[ ][ ][ ]' N [ ][ ]° [ ][ ].[ ][ ][ ]' E
  TO   WPT     = [ ]  (01~99)
  LAT/LONG:  37° 00.000' N 132° 00.000' E
  RANGE        = [ ][ ][ ].[ ] NM
  BEARING      = [ ][ ][ ].[ ]°
```

By range/bearing from a WAYPOINT

By range/bearing from known LAT/LONG

[CLR] [ ] [ ] [ENT]
Enter WPT No. (00-99)

[∇]

[CLR] [ ] [ ]° [ ] [ ].[ ] [ ] [ ]' ([+/–])
deg. min. └ N/S

[ ] [ ] [ ]° [ ] [ ].[ ] [ ] [ ]' ([+/–]) [ENT]
deg. min. └ E/W

[∇]

[∇]

[CLR] [ ] [ ] [ENT] ----- Enter a waypoint number (TO WPT) for the target position.

[∇]

[CLR] [ ] [ ] [ ] [ ]. [ ] [ENT] ----- Enter a RANGE.

[∇]

[CLR] [ ] [ ] [ ]. [ ] [ENT] ----- Enter a BEARING.

Lat/long of the new waypoint is presented.

[∇]

for another registration

NOTE: 1. Waypoints in use for the waypoint navigation or routing navigation can be overwritten. Confirm unimportance of the waypoint before doing so.

2. A radar target may be registered as a waypoint as follows.

(1) Register the present position as a waypoint. Refer to page 18.

(2) Measure the distance and bearing of the radar target, using the VRM (Variable Range Marker) and EBL (Electronic Bearing Line) if available.

(3) Register the radar target as a waypoint as described on the preceding page. The waypoint registered in step (1) should be utilized as the FROM WPT.

Registering by EVENT POSITION

• while saving an event position ----------> Page 18

• while recalling an event position --------> Page 20

Presenting WAYPOINT LIST

A list of all waypoints registered in the unit can be displayed.

[MENU] [3] [0]

```
  WAYPOINT    LIST (+/-:DATE)
▲18 (LOOKOUT ) :  34° 00.000' N  135° 21.000' E
 19 (HATTERAS) :*34° 30.000' N  135° 31.000' E
 20 (HENRY    ) :  35° 00.000' N  135° 41.000' E
 21 (CHARIES  ) :  35° 30.000' N  135° 51.000' E
 22 (MAY      ) :*36° 01.090' N  136° 34.780' E
▼23 (ATLANTIC) :  36° 33.245' N  136° 17.801' E
```

WPT# (comment) lat. long.

* Write-protected (LOCKed)

[+/–] ------- Every press of this key calls up the lat/long page (above) and the date/time page (below) alternately.

```
  WAYPOINT    LIST (+/-:  L/L)
▲18 (LOOKOUT ) :MAR 08 '89 23:45' 27" G  MNU
 19 (HATTERAS) :FEB 28 '89 03:40' 00" G  MNU
 20 (HENRY    ) :JAN 18 '89 08:35' 00" G  MNU
 21 (CHARIES  ) :DEC 03 '88 13:45' 00" G  MNU
 22 (MAY      ) :NOV 23 '88 20:00' 12" G   LC
▼23 (ATLANTIC) :NOV 23 '88 22:14' 45" G  GPS
```

WPT# (comment) Mon Day 'Yr Hr: Min' Sec"

ENTRY MODE

MNU... Entered MaNUally by lat/long.
CLT.... Entered manually by range/bearing. (L/L were CaLculated.)

In case of the waypoint which was registered from an event position, date/time and navaid ID at the moment of event position entry are presented:

GPS .....GPS
GDR ....Back-up by Dead Reckoning using Speed/Heading Data
DR .....Back-up by SATNAV (TRANSIT)
LC .....Back-up by LORAN-C
LA .....Back-up by LORAN-A
OM .....Back-up by OMEGA
DC .....Back-up by DECCA
---.....See page 12.

To scroll up and down the presentation, press [Δ] and [∇].

WAYPOINT / WAYPOINT

WAYPOINT NAVIGATION (between 2 waypoints)

Use this method when you want to navigate to a waypoint directly without making a course change on the way. We call the origin and the destination the FROM and the TO WAYPOINTS, respectively.

Selecting FROM and TO WAYPOINTS

[FR/TO]

```
▶ WPT = 00 ⟶ __
```

Specifying the PRESENT POSITION as an origin.

[ ][ ][ENT] --- Enter TO WPT only.

Note that the ship's position at this moment is automatically registered as WPT# 00 and is selected as FROM WAYPOINT.

Specifying a WAYPOINT as an origin

[CLR] [ ][ ] [ ][ ] [ENT]
from to

If [ENT] is pressed immediately after [CLR], the waypoint navigation function is disabled.

About 2 seconds later the [RNG·BRG] presentation appears automatically. Be certain that TO and FROM WAYPOINTS are selected properly.

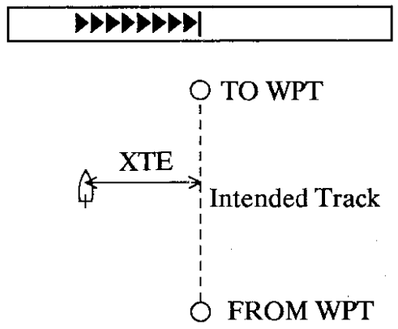
NOTE: If the above operation is performed during the routing navigation, the routing navigation is totally cancelled.

Nav. Data Presentation & Ship Steering

When FROM and TO WAYPOINTS are selected, the following nav. data are presented.

Page 14	[SPD, CRS] --------->	VTD	(Velocity To Destination)
Page 15	[RNG, BRG] ------->	RNG BRG	(Range/bearing of TO WPT observed from PRESENT POSITION)
Page 16	[XTE] ---------->	XTE ΔC	(Cross-track Error) (Course Error)
Page 17	[TTG] ---------->	TTG ETA	(Time to go to TO WPT) (Estimated time of arrival at TO WPT)

The cross-track error is also presented graphically as illustrated below.



Number of ◄ or ► changes in accordance with the cross-track error amount. When the ship is on the track line, ⋈ is presented. See page 12 (2) for details.

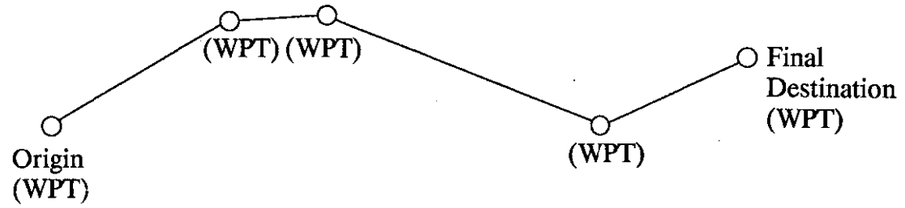
To return to the intended track, steer the helm in the direction indicated by the arrows.

WAYPOINT

ROUTE

HANDLING ROUTES

In many cases, a voyage from the origin to the final destination involves several course changes, requiring a series of waypoints which you navigate to, one after another. The sequence of waypoints leading to the final destination is called a ROUTE.



Registering ROUTES

by using WAYPOINTS

[MENU] [5] [0]

```
  ROUTE  PLAN                          (▒▒▒:DATE)
➡ROUTE NO   = 03  (00~10)
 0) WPT=05 : *34° 11.205' N  135° 56.329' E  GPS
 1) WPT=13 :  34° 20.200' N  135° 40.000' E  MNU
 2) WPT=27 :  34° 30.200' N  135° 30.000' E  MNU
 3) WPT=45 :  34° 40.200' N  135° 20.000' E  MNU
 4) WPT=11 :  34° 55.220' N  135° 13.080' E  *LC
```

WPT# · Lat. · Long. · Mode

* LOCKed

Serial No. (0 = origin)

Every hit of [+/–] calls up the above and the following presentations alternately.

```
  ROUTE  PLAN                          (▒▒▒:  L/L)
➡ROUTE NO   = 03  (00~10)
 0) WPT=05 (YARMOUTH) FEB 15 '89  13:45' 09" G
 1) WPT=13 (SABLE   ) FEB 15 '89  13:46' 45" G
 2) WPT=27 (HALIFAX ) FEB 15 '89  13:47' 38" G
 3) WPT=45 (CANSO   ) FEB 15 '89  13:48' 23" G
 4) WPT=11 (SYDNEY  ) FEB 15 '89  13:49' 59" G
```

Comment · Mon Day 'Yr Hr: Min Sec

Date/time of WPT entry

[CLR] [ ] [ ] [ENT] ---- Enter a ROUTE NO.

NOTE: The route number which is currently used for navigation can not be entered.

Registering a route

Deleting a route

[CLR] [ENT]

If [CLR] is followed by [ENT], the above-entered ROUTE No. is deleted from the registration.

For another WPT

[▽]

[CLR] [ ] [ ] [ENT]
WPT#

By repeating this operation, enter intermediate and destination waypoints (max. 10 points) serially.

NOTE: 1. The waypoints must be registered beforehand.

2. Route# 00 may be presented, but waypoints can not be entered in it because it has a special usage as described later on.

Deleting a Waypoint from Route

(1) By pressing [△] or [▽], move arrow ⇒ to the waypoint number which you want to delete from the route.

```
  ROUTE  PLAN                          (  :DATE)
 ROUTE NO   =  03  (00~10)
  0) WPT= 05 : *34° 11.205' N  135° 56.329' E  GPS
  1) WPT= 13 :  34° 20.200' N  135° 40.000' E  MNU
➡ 2) WPT= 27 :  34° 30.200' N  135° 30.000' E  MNU
  3) WPT= 45 :  34° 40.200' N  135° 20.000' E  MNU
  4) WPT= 01 :  34° 55.220' N  135° 13.080' E  *LC
```

In this example, WPT No.27 will be deleted from Route No.03.

(2) Press [CLR] and [ENT] in this order, and the route is re-organized, excluding the waypoint. (The deleted line remains blank on the display.)

by using VOYAGE PLAN function

The GP-500 is provided with a navigational calculation function, called the VOYAGE PLAN, which determines the shortest course between two waypoints. Specify origin and destination waypoints, and the GP-500 calculates the great circle course (page 47) between them, and generates waypoints on it at equal distances. The route involving thus-generated waypoints is registered automatically as Route No.00. Use this function for a long range navigation, such as a transoceanic one.

[MENU] [4]

```
  VOYAGE  PLAN
➡FROM WPT        =  12        (01~99)
 TO   WPT        =  18        (01~99)
 NO OF WPT       =   5        ( 1~9 )
 SPD FOR CALC    =  20.5KT     (00.1~99.9KT)
 ROUTE NUMBER    =  00
 RESULTS         :
```

[CLR] [ ] [ ] [ENT] ----- Enter FROM WPT No. ------ origin

[▽]

[CLR] [ ] [ ] [ENT] ----- Enter TO WPT No. ------- destination

[▽]

[CLR] [ ] [ENT] ----- Enter number of intermediate waypoints, excluding FROM WPT and TO WPT.

[▽]

[CLR] [ ] [ ]. [ ] ----- Enter a cruising speed for TTG (Time To Go) calculation described on the next page.

[▽] -----> Arrow ⇒ points to "RESULTS."

[▽] -----> Calculation results on the FROM WPT (starting point) are presented as illustrated on the next page.

Calculation results on this waypoint is currently displayed.

WPT lat/long

```
  VOYAGE  PLAN (RESULTS)
WPT  (FROM)      : 12
LAT/LONG         : 47° 00.000' N 100° 00.000' E
RNG/BRG          : ----.-NM   ---.-°
TTG              : --D--H--M
TOTAL RNG/TIM    : ----.-NM   ---D--H--M
→RESULTS
```

The automatically generated waypoint numbers are P1, P2, -----. The calculation results on these points are presented one after another at every two depressions of the [▽] key. See the illustration below.

Range/bearing observed from the preceding waypoint.

WPT numbers generated by VOYAGE PLAN are P1, P2, P3, ----- .

```
  VOYAGE  PLAN (RESULTS)
WPT              : P1
LAT/LONG         = 48° 06.4278' N 100° 12.1415' E
RNG/BRG          :  103.2NM   178.6°
TTG              : --D05H27M
TOTAL RNG/TIM    :  103.2NM   ---D05H27M
→RESULTS
```

TTG (Time To Go) from the preceding waypoint is calculated by using the cruising speed entered on the preceding page.

Total sum of RANGE and TTG from the origin.

If you wish to display the waypoint data in the reverse direction, press the [△] key instead of [▽].

How to modify calculation results

If an island exists on Route No.00 for example, you may avoid it by modifying the lat/long on specific waypoint(s);

Call up the waypoint in question by the above-mentioned method.

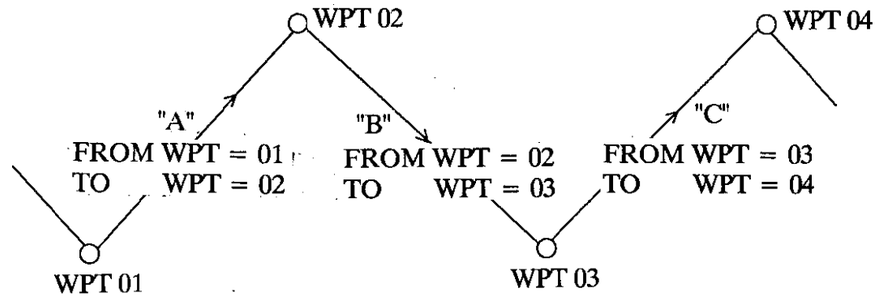
[△] or [▽] ----- Move arrow ⇒ to the "LAT/LONG" line.

For another WPT

[CLR] [ ][ ]° [ ][ ].[ ][ ][ ]' ([+/–]) [ ][ ][ ]° [ ][ ].[ ][ ][ ]' ([+/–]) [ENT]
deg. min. └N/S deg. min. └E/W

ROUTING NAVIGATION

This section explains how to select a route and follow it. One complete route can be broken into several segments, and you can travel each segment by using waypoint navigation. Suppose that the following route is available.



- When travelling segment A, 01/02 should be selected as FROM/TO WPT's.
- When travelling segment B, 02/03 should be selected as FROM/TO WPT's.
- When travelling segment C, 03/04 should be selected as FROM/TO WPT's.

When following a route, you need not change FROM and TO WAYPOINTS manually whenever the ship reaches an intermediate waypoint. The machine will do it for you.

NOTE: 1. The machine switches FROM and TO WAYPOINTS when the ship enters into the ARRIVAL ALARM zone described on page 39.

2. Asterisk-marked nav. data explained from page 14 are calculated for the currently selected FROM and TO WAYPOINTS.

Selecting a Route

[MENU] [5] [1]

```
  ROUTE  SELECT (+/-:WPT UPDT)
→ROUTE NO        = 03    (00~09)
 ROUTE NAV       = FORWARD
                   (1:FORWARD 0:REVERSE)
 ROUTE 03 (45→11)
    :05→13→27→45→11→16→39→12
 DISABLE WPT     = [2][7]
```

[CLR] [ ] [ ] [ENT] ----- Enter a ROUTE NO.

If [ENT] is pressed immediately after [CLR], the routing navigation function is disabled.

[▽]

[CLR] [ ] [ENT] ---------- Enter [0] to navigate in the FORWARD direction.
Enter [1] to navigate in the REVERSE direction in the return voyage.

[▽]

---------- Omitting specific intermediate waypoints ----------

[CLR] [ ] [ ] [ENT] ---------- Enter waypoint number(s) which you want to omit (disable), and the GP-500 re-calculates the route excluding the disabled waypoints.

```
ROUTE SELECT (+/-:WPT UPDT)
ROUTE NO      = 03   (00~09)
ROUTE NAV.    = REVERSE
                (1:REVERSE 0:FORWARD)
ROUTE 03 (00→12)
   :05←13←27←45←11←16←39←12
➡DISABLE WPT  = 45
```

Disabled waypoints are presented in reverse mode. If you want to enable a waypoint again, enter its number in the same manner.

ROUTE No. in use (currently selected FROM WPT → TO WPT)

When a route is selected, the present position is registered as WPT 00, and selected as the initial FROM WPT. The initial TO WPT is the first waypoint on the route, e.g., WPT 12 in the above example.

Manual (forced) change of FROM and TO WAYPOINTS

As described before, FROM and TO WAYPOINTS are changed when the ship enters into the arrival alarm zone. However, if the alarm zone is set too small for the ship to enter, FROM and TO WAYPOINTS can not be changed. In such a case, press [+/–] with the ROUTE SELECT presentation called up on the screen, and the FROM and TO WAYPOINTS change even if the boat is outside of the alarm zone.

For example, FROM and TO WAYPOINTS are 00 and 12 respectively in the above example. When you press [+/–], FROM and TO WAYPOINTS change to 12 and 39 respectively.

NOTE: If a route is selected during the waypoint navigation, the waypoint navigation is totally cancelled.

ALARM FUNCTIONS

This chapter describes usages of various alarm functions. The alarm is released both audibly and visually. When an audible alarm (peep) is released, you may silence it by pressing [RST]. For the visual alarm, see the next chapter.

TIMER/STOPWATCH and WAKE UP Functions

TIMER .....Alarm is released when a set time has elapsed.
STOPWATCH .....On-screen stopwatch for counting-up time.
WAKE-UP .....Alarm is released every day when specified time has come.

Presetting Timer/Stopwatch and Wake-up Time

[MENU] [2]

```
TIMER SET
➡MODE SELECT    = TIMER  (1:TIMER 0:WATCH)
  HOUR          = 02H00M00S
  REPEAT        = ON     (1:ON 0:OFF)
  BUZZER        = ON     (1:ON 0:OFF)
WAKE UP TIME    = 06H25M
  BUZZER        = ON     (1:ON 0:OFF)
```

---------- Setting Timer/Stopwatch ----------

[CLR] [ ] [ENT] ----- Select a MODE between [1] TIMER and [0] STOPWATCH.

[▽]

If the STOPWATCH mode is selected, the HOUR, REPEAT, and BUZZER indications are not presented.

If the TIMER mode is selected;

[CLR] [ ][ ] [ ][ ] [ ][ ] [ENT] --- Enter HOUR (time) desired.
hr. min. sec.
└00 to 99

[▽]

[CLR] [ ] [ENT]

Select [1] if you want repeated count down sequence and alarm at every bottom count.

Select [0] for one-time count down.

[▽]

[CLR] [ ] [ENT] ---- Select [1] BUZZER = ON if you need a peep.

[▽]

NOTE: To start the timer or stopwatch see the next page.

---------- Setting a Wake-up Time ----------

[CLR] [ ][ ] [ ][ ] [ENT] ----- Enter a WAKE-UP TIME.
hr. min.
(00-23)

[▽]

[CLR] [ ] [ENT] ----- Select [1] BUZZER = ON if you want to disable both visual/audible alarms.

Starting the Timer/Stopwatch

[MENU] [1]

If the TIMER mode is selected on page 35;

If the STOPWATCH mode is selected on page 35;

S. WATCH: 00H34M44S

(▲:START ▼:STOP ▮/◢:LAP)

For another round

[Δ] ---------> The on-screen stopwatch is reset and then starts counting up.

If you want to read a LAP time, press [+/–]. Although the reading freezes, the stopwatch is ticking internally. To return to the stopwatch reading, press [+/–] again.

[▽] ---------> The stopwatch freezes.

NOTE: Unless [▽] is pressed, the stopwatch counts up to 99H59M59S, then resets to 00H00M00S, and up-counting resumes.

Timer Mode Presentation

```
TIMER    :  01H34M44S

(▲:START  ▼:STOP  #/=:RESET)
```

[Δ]

The on-screen timer starts counting down from the time which was preset on page 35.

Press [∇] for pause, and [Δ] to restart the counting down operation.

Timer operation is repeated automatically.

When the timer has reached 00H00M00S;

If [1] REPEAT = ON is selected on page 35;	If [0] REPEAT = OFF is selected on page 35;
a peep is generated 3 times.	a continuous peep is generated.

ALARM ALARM

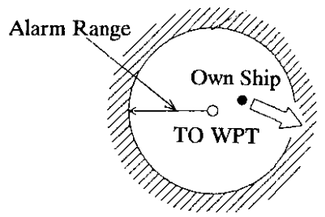
NOTE: If [+/–] is pressed during the down-counting operation, the timer returns to the preset time. If you want to start the timer, press [Δ]

ANCHOR WATCH/ARRIVAL, CROSS-TRACK ERROR/ BORDER & SPEED Alarms

Function of each alarm is briefed below. This section shows the procedure to operate these alarms.

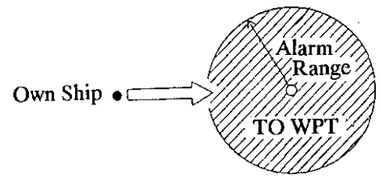
What's an ANCHOR WATCH Alarm ?

The alarm is triggered when the ship leaves the TO WPT, exceeding the alarm range.



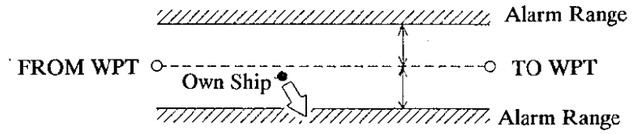
What's an ARRIVAL Alarm ?

The alarm is triggered when the ship enters into the alarm zone on the TO WPT.



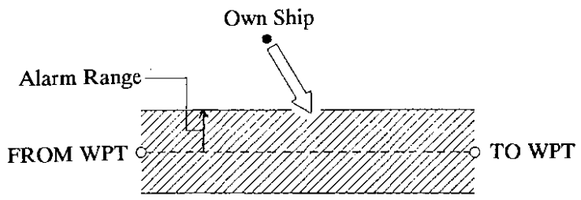
What's a CROSS-TRACK ERROR Alarm ?

The alarm is triggered when the cross-track error exceeds the alarm range.



What's a BORDER Alarm ?

First, register two waypoints on a border line, then select them as FROM and TO WAYPOINTS. The alarm is triggered when the ship enters into the alarm zone on the border line.



What's a SPEED Alarm ?

The MAXIMUM and MINIMUM modes are available:

MAX. Mode --------- The alarm is triggered when the ship's speed becomes higher than the preset value.

MIN. Mode ---------- The alarm is triggered when the ship's speed becomes lower than the preset value.

PROCEDURE

[MENU] [6]

Anchor Watch/Arrival Alarms

[CLR] [ ].[ ] [ ] ([+/–]) [ENT] ----- Enter an alarm range.
Press to select either the ANCHOR WATCH or ARRIVAL ALARM.

```
   A L A R M
→ANCHOR WATCH=  1.25NM   (+/-:  ANCHR/ARRIV)
  MONITOR     =  ON      (1:ON  0:OFF)
```

[▽]

```
   A L A R M
→ARRIVAL      =  1.25NM  (+/-:  ANCHR/ARRIV)
  MONITOR     =  ON      (1:ON  0:OFF)
```

[CLR] [ ] [ENT] ----- Select [1] MONITOR = ON to enable the alarm function, or [0] MONITIOR = OFF to disable it.

[▽]

Cross-track Error/Border Alarms

[CLR] [ ].[ ] [ ] ([+/–]) [ENT] ----- Enter an alarm range.
Press to select either the CROSS-TRACK ERROR or BORDER ALARM.

```
→XTE          =  2.75NM  (+/-:  XTE/BORDER)
  MONITOR     =  ON      (1:ON  0:OFF)
 MAX. SPEED   =  12.9KT  (+/-  :  MAX/MIN)
 ALARM BUZZER=  ON       (1:ON  0:OFF)
```

[▽]

```
→BORDER       =  2.75NM  (+/-:  XTE/BORDER)
  MONITOR     =  ON      (1:ON  0:OFF)
 MAX. SPEED   =  12.9KT  (+/-  :  MAX/MIN)
 ALARM BUZZER=  ON       (1:ON  0:OFF)
```

[CLR] [ ] [ENT] ------ Select [1] MONITOR = ON to enable the alarm function or [0] MONITOR = OFF to disable it.

[▽]

Speed Alarm

[CLR] [ ] [ ]. [ ] ([+/–]) [ENT] ----- Enter the threshold value. (Enter "00.0" if you want to disable the alarm.)
Press to select either the MAXIMUM or MINIMUM mode.

[▽]

[CLR] [ ] [ENT] ------ Select [1] ALARM BUZZER = ON if you need a peep. (A peep is generated if any alarm is breached.)

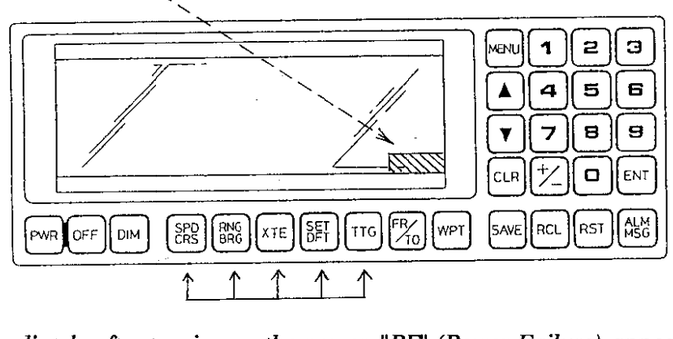
ALARM

ALARM/ERROR MESSAGES

Interpreting ALARM/ERROR INDICATIONS

When any alarm condition is breached or error is detected, a peep is generated. To identify the cause of the audible alarm, observe the alarm/error indication presented on the bottom right corner of the screen.

Alarm/error indication is presented on the nav. data screens which are called up by the following five keys.



NOTE: 1. Immediately after turning on the power, "PF" (Power Failure) appears, but you may disregard it. It will disappear upon pressing any key.

2. Audible alarm (peep) can be silenced by pressing [RST], but an alarm/error indication can not be cleared manually. It will disappear when the cause of the alarm/error is removed.

3. When a several alarm and/or error conditions are breached, their indications appear alternately in the same area on the screen.

ALARM Indications

When the alarm functions are enabled, the following indications are continually presented. They blink at 1.5 second intervals when alarm conditions are breached. The audible alarm is a continuous peep.

HOUR .... TIMER reached zero.
TIME ..... WAKE-UP TIME has come.
ANCH .... ANCHOR WATCH alarm breached.
ARV ..... ARRIVAL alarm breached.
XTE ..... CROSS-TRACK ERROR alarm breached.
BDR ..... BORDER alarm breached.
SPD ..... SPEED alarm breached.

ERROR Indications

When any abnormality is detected during operation, error indication appears and blinks at 1.5 second intervals. A peep is also generated 3 times at the same interval.

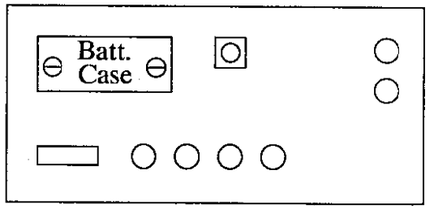
SERR ---- SELF-TEST ERROR

The GP-500 tests its own function periodically. If any abnormality is detected, this error indication appears. To locate the faulty part, conduct the manual SELF-TEST described on page M-2.

BERR ---- BATTERY ERROR

Memory contents of the GP-500 are preserved by the internal lithium battery of which the estimated life is 4 years. This indication appears when the battery voltage is getting low. Set two pieces of UM4 dry cells in the battery case which is located on the rear panel. The life time of the dry cell is one year or so. You may leave the wasted lithium battery inside. There is no fear of liquid leakage for more than 10 years. Of course, you may call a technician to replace the lithium battery.

When BERR appears next time, replace the dry cells in the battery case.



NOTE: 1. While the GP-500 is turned on, the battery is not consumed.

2. Even if the power is turned off without batteries, memory contents are preserved for about 24 hours.

DERR ---- DATA ERROR

Invalid data was found in the power-on self-test. Memory contents may have been destroyed by shortcircuit, intensive noise, abnormal fluctuation of supply voltage, etc. Press [ALM MSG]. See page 45.

RERR ---- RECEIVE ERROR

Data has not been received for more than 30 seconds from the back-up navaid. (gyrocompass, loran, etc.) Check the back-up navaid and connection cable.

HDOP ---- HDOP ALERT (GP-500 is normal.)

3 satellites (4 satellites in case of the 3-D mode) are available in line-of-sight, but their HDOP is inferior to the HDOP threshold entered on page M-9.

PF -------- POWER FAILURE

Disregard "PF" when it appears immediately after power-on. When a power failure (even a momentary one) is detected thereafter, "PF" appears again. Check the ship's power supply.

Calling up Full Text of ALARM/ERROR MESSAGES

If several alarms or errors are breached simultaneously, it may be difficult to recognize the indications because they are presented alternately. The following function presents a full text of Alarm/Error messages one by one.

When [ALM MSG] is pressed, one of the following messages is presented.

NOTE: The date/time which appear on every presentation indicates when the alarm or error condition began.

No alarm/error condition

NO ALARM

FEB 12 13:25' 56" G

ALARM Messages

HOUR

ELAPSED HOUR ALARM
SET TIME : 01H15M00S
FEB 12 13:25' 56" G

TIME

WAKE UP TIME ALARM
WAKE UP TIME : 16H45M
FEB 12 13:25' 56" G

ANCH

ANCHOR WATCH ALARM
ALARM RANGE : 2.50NM
FEB 12 13:25' 56" G

ARV →

ARRIVAL ALARM

ALARM RANGE : 2.50NM

FEB 12 13:25' 56" G

XTE →

OFF COURSE ALARM

ALARM RANGE : 2.50NM

FEB 12 13:25' 56" G

BDR →

BORDER ALARM

ALARM RANGE : 2.50NM

FEB 12 13:25' 56" G

SPD →

SPEED ALARM

ALARM RANGE : 10.0KTS

FEB 12 13:25' 56" G

ERROR Messages

SERR →

SELF TEST ERROR

FEB 12 13:25' 56" G

BERR →

BATTERY ERROR ALARM

FEB 12 13:25' 56" G

ALARM

ALARM

DERR →

BACK UP DATA ERROR!!

CLEAR DATA?? (1: YES/OTHER KEY: NO)

FEB 12 13:25' 56" G

- If the error is detected at the power-on self-check, this message appears automatically.
- If you forgot to write waypoints in a log for example, escape from the above screen by pressing any key (other than [1]) and [ENT] in this order, call up waypoints on the screen to write those L/L in a log, then press [ALM MSG] again. Now you may proceed to the following operation.
- Press [1] and [ENT] in this order, and all the memories including waypoints and after-installation settings are cleared/initialized. (Almanac is not cleared.) Perform the after-installation parameter setting described from page M-8.

HDOP →

HDOP ERROR ALARM

HDOP THRESHOLD : 10

FEB 12 13:25' 56" G

PF →

POWER FAIL ALARM

FEB 12 13:25' 56" G

If a several alarms/errors exist, "CONTINUE" is presented at the bottom right corner as illustrated below. Press [ALM MSG] repeatedly, and every message is called up one after another.

ALARM

CONTINUE

MISCELLANEA

RANGE/BEARING Calculation

Range/bearing between any two locations can be calculated.

[MENU] [3] [1]

```
CALCULATION
►FROM WPT      =    (00~99)
      LAT/LONG=  34° 00.000' N 135° 00.000' E
  TO  WPT      =    (00~99)
      LAT/LONG=  37° 00.000' N 132° 00.000' E
```

Specifying the origin by WPT No.

[CLR] [ ] [ ] [ENT] --Enter FROM WPT.

[▽] Lat/long of the WPT (except WPT 00) may be changed.

Specifying the origin by LAT/LONG.

[▽]

[CLR] [ ][ ]° [ ][ ].[ ][ ][ ]' ([+/–]) --- lat.
deg. min. └ N/S

[ ][ ][ ]° [ ][ ].[ ][ ][ ]' ([+/–]) [ENT] ---- long.
deg. min. └E/W

for another round of calculation

[▽]

Specifying the target point by WPT No.

[CLR] [ ] [ ] [ENT] --Enter TO WPT.

[▽] Lat/long of the WPT (except WPT 00) may be changed.

Specifying the target point by LAT/LONG.

[▽]

[CLR] [ ][ ]° [ ][ ].[ ][ ][ ]' ([+/–]) ----- lat.
deg. min. └ N/S

[ ][ ][ ]° [ ][ ].[ ][ ][ ]' ([+/–]) [ENT] ---- long.
deg. min. └E/W

The GREAT CIRCLE and RHUMB LINE COURSES (range/bearing) are presented.

```
RESULTS RHUMB LINE   :   350.0NM   58.2°
        GREAT CIRCLE :   348.9NM   56.4°
```

[▽]

MISCELLANEAS

NOTE: The waypoints used for the waypoint navigation or routing navigation can be overwritten by this operation. Confirm unimportance of the waypoint before doing so.

GREAT CIRCLE Course vs. RHUMB LINE Course

The great circle course is the shortest path which is obtained by stretching a string between two locations on the earth (sphere). The great circle course is usually used for a long range navigation, such as a transoceanic route. In order to follow this course faithfully, the helm must be steered continually.

The rhumb line course is the pseudo shortest path which is obtained by stretching a string between two locations on a chart (flat surface). To follow the rhumb line course, the ship's heading may be fixed. If the distance is short, the rhumb line course is practically the same as the great circle course.

Unless noted otherwise, rhumb line or great circle course (range/bearing) is presented on the GP-500, depending on the setting on page M-19.

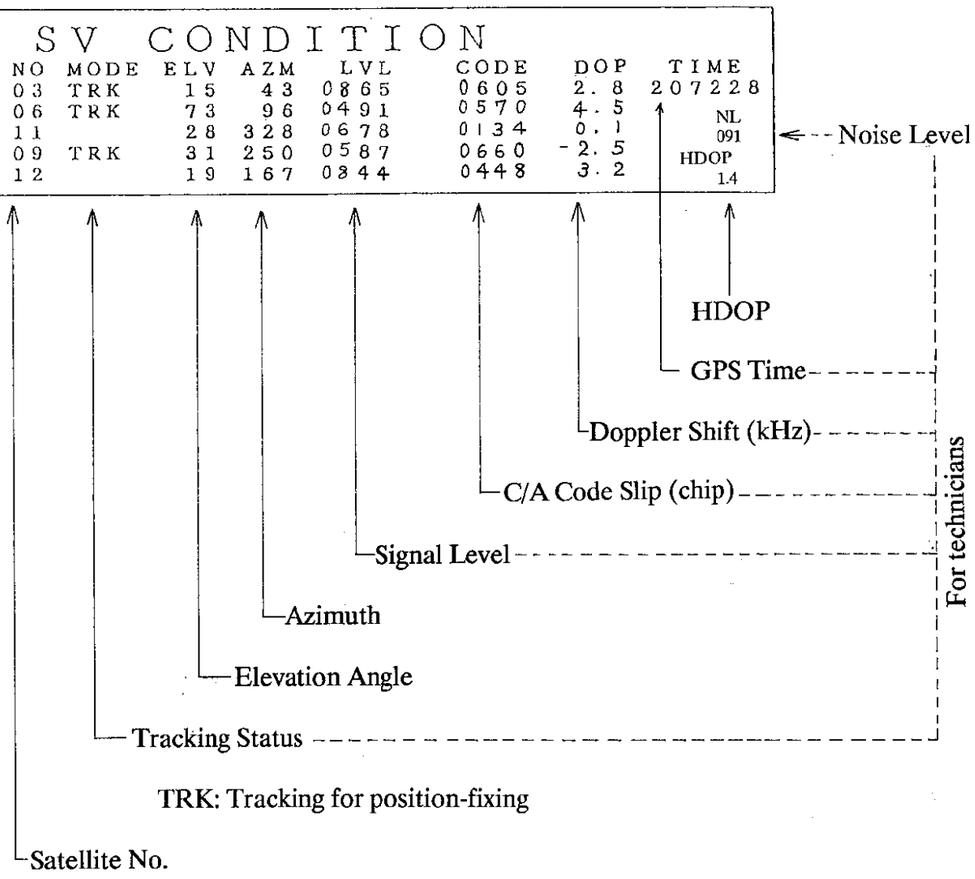
MAINTENANCE

This chapter provides information for evaluating GP-500's condition. Procedures described in this chapter may be performed by the user, however any repair is best left to a qualified technician.

SV CONDITION Presentation

[MENU] [9] [7]

The GP-500 knows from the Almanac what satellites (space vehicles, SV) are presently available in line of sight, and displays their conditions as illustrated below.



SELF-TEST and KEYBOARD TEST

Self-Test

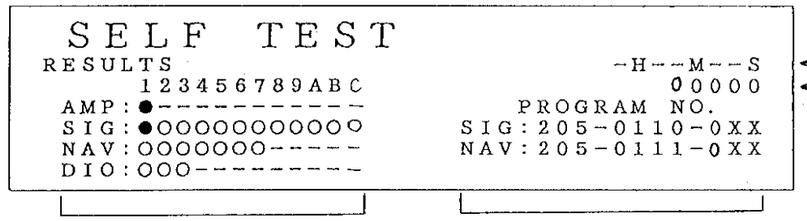
As mentioned earlier, GP-500's function is tested periodically, and "SERR" is presented if any abnormality is detected. This self-test is initiated by the GP-500 itself, and can not be controlled by a user.

The self-test discussed in this paragraph is a different type self-test which is initiated by a user. Note that GP-500's original functions (position-fixing etc.) are disabled during the self-test.

[MENU] [9] [8] [0]

Self-test results are presented.

Elapsed time since the self-test was initiated.



See the next page.

The AMP,SIG,NAV,and DIO boards are tested. If " ● " is presented, that pc board is faulty.

ROM Program numbers are displayed. "XX" is a version number, and may differ with respect to unit.

To cease the self-test, press any key except [DIM].

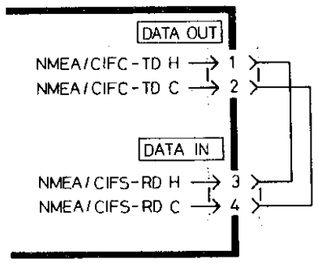
```
-H--M--S
 0 0 0 0 0
```

Test results of the communication interfaces.

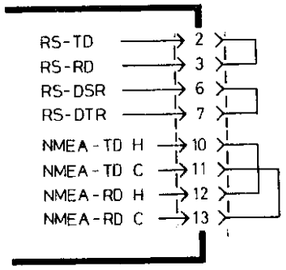
If normal, "1" is presented.
If not normal, "0" is presented.

This test is done with the rx inputs coupled to the tx outputs with jumpers as shown below. The GP-500 transmits a test data and receives it. If the received data matches the transmitted one, "1" is presented. If a jumper is not connected or an external equipment is connected, "0" is presented. See the interconnection diagram on page S-1.

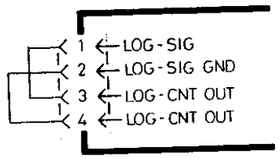
Test results of the [DATA OUT] / [DATA IN] connectors.



Test results of the [DATA IN/OUT] connector.



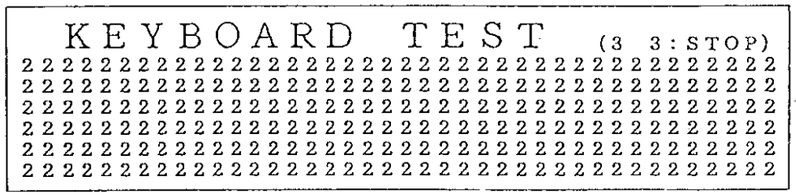
Test result of the [LOG] connector.



Keyboard Test

This test checks the keyboard for proper operation.

[MENU] [9] [8] [1]


KEYBOARD TEST (3 3:STOP)
2 2 2

MEMORY CLEAR

The following operation clears some or all memories in the GP-500. Use this function when error indication "DERR" (Data Error)is presented or when someone has entered a lot of wrong data and you want to initialize the memories. Note that waypoints are also cleared.

[MENU] [9] [8] [2]

```
  MEMORY  CLEAR
→DATA     CLEAR = -----   (1:  YES   )

 ALL      CLEAR = -----   (1:  YES   )
```

If you want to clear all the memories including Waypoints/Almanac;

If you want to keep LOCKed Waypoints, Almanac, and the following data;

- [MENU] [0] ..... INITIAL DATA (1)
- [MENU] [9] [0] ... INITIAL DATA (2)
- [MENU] [9] [1] ... DATUM SELECT
- [MENU] [9] [2] ... LOGGYRO DATA
- [MENU] [9] [3] ... BACK UP SELECT
- [MENU] [9] [4] ... MAGNETIC CORRECTION
- [MENU] [9] [5] ... DISPLAY UNIT
- [MENU] [9] [9] ... I/O DATA SELECT

[CLR] [1] [ENT] ----> DATA CLEAR operation begins.

When the DATA CLEAR operation is completed, the screen is cleared up and then the previous presentation (MEMORY CLEAR) reappears.

[▽]

CAUTION

After the following operation, Almanac must be received. If you know the satellite number which is available in line of sight, Almanac may be received soon as explained on page M-7. If not, it will take a long time until Almanac reception begins.

[CLR] [1] [ENT] -----> ALL CLEAR operation begins.

When the ALL CLEAR operation is completed, the screen is cleared up and then the previous presentation (MEMORY CLEAR) reappears.

Perform PARAMETER SETTING AFTER INSTALLATION described from page M-8.

NOTE: The default settings after the ALL CLEAR are found on page M-31.

In order to receive the Almanac, conduct the COLD START described below.

COLD START (erasing/receiving ALMANAC)

If the GP-500 has been left unused for a long time, half a year for example, it may not acquire a satellite because the existing Almanac is too old to predict a proper satellite arrival time. In such a case, perform the COLD START described below, resulting that the existing Almanac is cleared and a new one will be received. Note that extreme error contained in the present time or lat/long also causes the said trouble. If necessary, reenter INITIAL DATA (1) described on page M-8.

CAUTION

If you know the satellite number which is available in line of sight,Almanac may be received in twenty and a few minutes. Unless a satellite number is known, it will take a long time (a several tens minutes in the worst case) before the Almanac reception begins. Unless a satellite is available in line of sight, it will take more.

[MENU] [9] [6]

The existing Almanac was received on this date/time.

```
  COLD  START
 ALMANAC D,T : FEB/12/1989  10:34' 04" G  12

→COLD START   = -        (1:  START )
  SV NUMBER   = ▒▒       (01~32)

 OFFSET FREQ  :-584Hz
```

The existing Almanac was received from this satellite.

[CLR] [1] [ENT] ----- The GP-500 clears the existing Almanac, and begins to acquire a satellite for Almanac reception. (The screen is cleared for a moment.)

```
  COLD  START
 ALMANAC D,T  :  ---/--/----  --:--' --" -

→COLD START   =  START   (▯:  START )
  SV NUMBER   =  --      (01~32)

 OFFSET FREQ  : -584Hz
```

Presentation for technicians

If you do not know the SAT. No. which is available in line of sight;

If you know it;

[▽]

[CLR] [ ] [ ] [ENT] ---- Enter Satellite No.

The GP-500 begins to acquire/receive this satellite directly.

Since Almanac is not available, the GP-500 can not know what satellite is currently available in line of sight. So, it tries to acquire all the satellites from Sat. No.1 sequentially, and receives Almanac when the satellite in line of sight is acquired.

If Sat. No.1 is luckily in line of sight, Almanac reception begins soon. If a high number satellite is in line of sight, you will have to wait a long time,a few tens minutes in the worst case.Unless a satellite is presently available, you have to wait more.

When the Almanac reception has been completed, the ALMANAC DATE/TIME presentation appears.

BATTERY REPLACEMENT

See the description on "BERR" on page 42.

PARAMETER SETTING AFTER INSTALLATION

After the unit is installed, enter initial data and various parameters as instructed in this chapter.The settings may be changed in daily operations to meet various requirements in the field.

NOTE: 1. Although the memories are preserved internally even when the power is failed,it is a good idea to keep record of parameter setting just in case. It is recommended to fill in the blanks in this chapter.

2. The default settings are available on page M-31.

INITIAL DATA (1)

[MENU] [0]

```
  INIT  DATA (1)
→DATE  (M/D/Y)      =  10▯1/13▯/139▯8▯9
 TIME               =  1▯3 : 2▯5' 0▯0" J
 LOCAL ZONE TIME =▯▯0▯9 H▯0▯M
 LAT                =  3▯4° 4▯4. 0▯0' N
 LONG               = 1▯3▯5° 2▯▯. 0▯0' E
 HDOP THRESHOLD     =  0▯5 (01~99)
```

[CLR] [ ][ ] [ ][ ] [ ][ ][ ][ ] [ENT] ---- Enter today's DATE.
mon. day year
(Should be entered after ALL CLEAR only. Usually no need of entry.)

[▽]

[CLR] [ ][ ] [ ][ ] [ ][ ] [ENT] ---- Enter present TIME
hr. min. sec.
(00-23)
(Should be entered after ALL CLEAR only. Usually no need of entry.)

[▽]

NOTE: 1. You may enter GMT or any local date/time.

2. Although position-fixing can be initiated with the TIME setting including a large error, say one hour, enter a time as correctly as possible.

3. The setting is corrected automatically when position-fixing is performed.

[CLR] [ ][ ] [ ][ ] ([+/–]) [ENT] ----- Enter LOCAL ZONE TIME (time difference from GMT). See the next page.
hr. min.

If advanced from GMT, select + (no sign).
If delayed from GMT, select – (minus).

[∇] NOTE: You may enter any local zone time regardless of the ship's position.

[CLR] [ ][ ]° [ ][ ].[ ][ ]' ([+/–]) [ENT] ----- Enter estimated LATITUDE* of the present position with the accuracy better than 10 degrees.
deg. min. └N/S

[∇]

[CLR] [ ][ ][ ]° [ ][ ].[ ][ ]' ([+/–]) [ENT] ----- Enter estimated LONGITUDE* of the present position with the accuracy better than 10 degrees.
deg. min. └E/W

[∇] *NOTE: If HDOP is better than 99, the LAT/LONG settings are updated by GPS fix. If not, they are updated by the back-up navaid.

[CLR] [ ] [ ] [ENT] ---- Enter a HDOP THRESHOLD.

HDOP changes as time elapses. While HDOP is better (lower) than the above-entered threshold,GPS position-fixing is performed. When HDOP becomes worse (higher) than the threshold,the back-up navaid selected on page M-20 is used.

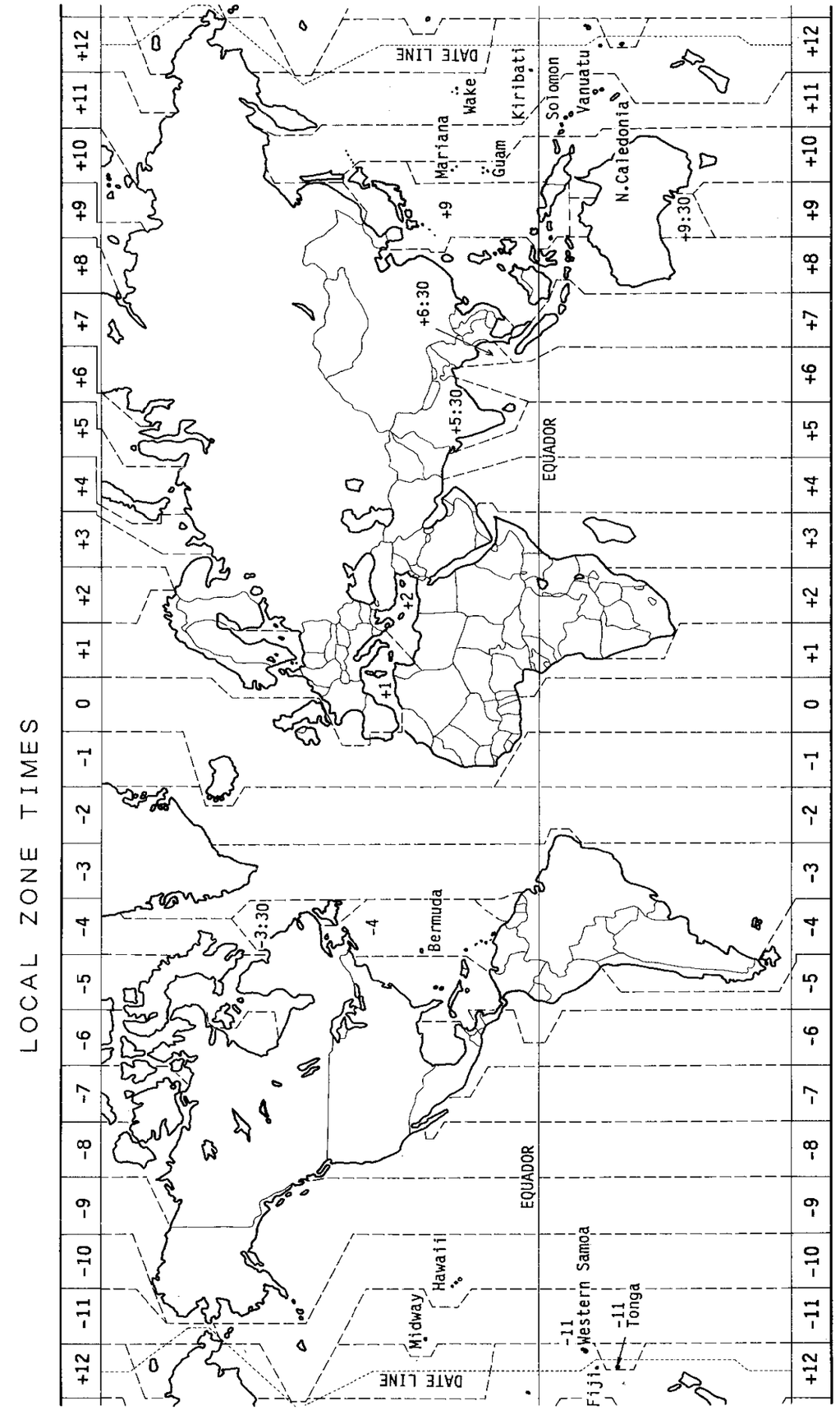
If the threshold is set low, GPS position-fixing is performed only when a high accuracy is expected.Trade-off of low setting of the HDOP threshold is short GPS position-fixing periods, e.g.long back-up periods.

Setting of 03 to 04 will be suitable for high accuracy GPS fix.Unless a back-up navaid is available, a higher setting, 08 or 09 for example, is preferable because GPS fix is obtainable for longer periods.

Call up the FUTURE POSITION-FIXING SCHEDULE ([MENU] [7]) with various HDOP threshold settings,and you can see how GPS position-fixing periods are influenced.

NOTE: 1. If BACK UP NAV = [1] NONE is selected on page M-20,GPS position-fixing is performed so long as 3 satellites (4 satellites in case of the 3-D mode)are available in line of sight regardless of the HDOP value.

2. Relationship between HDOP value and error in distance is available on page 4.



(**** This Page Intentionally Blank ****)

INITIAL DATA (2)

[MENU] [9] [0]

```
  INIT DATA (2)                    (▼:NEXT)
➔ANTENNA HEIGHT = 0015M
  L/L CORRECTION = 0.000' N 0.000' E
  L/L SMOOTHING  = 0  (0~9)
  S/C  SMOOTHING = 0  (0~9)
  DISABLE SAT    : 08 -- -- -- -- -- --
  DISABLE SAT    = 08
```

[CLR] [ ] [ ] [ ] [ ] [ENT] ---- Enter ANTENNA HEIGHT (altitude) above the sea level.

This parameter is used for 2-D mode position-fixing only. As this data is never updated, the error in the entered altitude affects the position-fixing accuracy continuously.Actually measure the antenna height as precisely as possible, and enter the measurement.

NOTE: 1 foot = 0.3m

[▽]

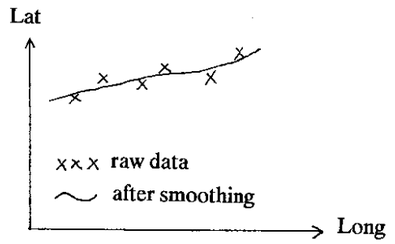
[CLR] [ ].[ ][ ][ ]' ([+/–]) [ ].[ ][ ][ ]' ([+/–]) [ENT] ---- Enter LAT/LONG CORRECTION.
min. └N/S min. └E/W

When a constant error is observed in a GPS fix, it may be offset.Only GPS fix is corrected; a back-up fix is not influenced by this offset setting.

[▽]

[CLR] [ ] [ENT] ---- Enter LAT/LONG SMOOTHING.

When the HDOP or receiving condition is unfavorable, the GPS fix fluctuates randomly.This fluctuation may be reduced by smoothing (averaging) the raw GPS fixes as illustrated below.



The higher the setting, the more smoothed are the raw data. If the setting is too high,the lat/long readings delay to respond to the actual change. This phenomenon is notable when the ship's speed is high. If "0" is entered, smoothing is not performed.

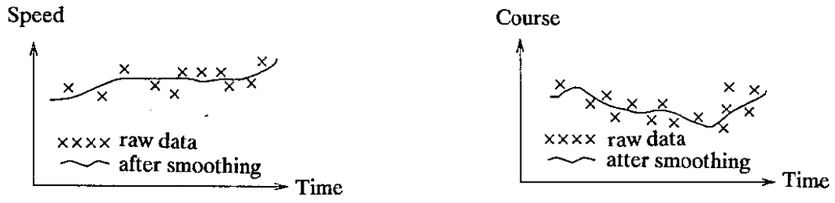
[▽]

Usually use "0", and increase the setting if the GPS fix fluctuates untolerably.

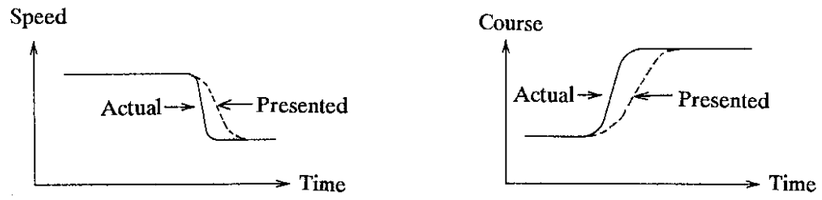
[▽]

[CLR] [ ] [ENT] ---- Enter S/C SMOOTHING.

During GPS position-fixing, ship's velocity (Speed/Course) is directly measured by receiving GPS satellites.The raw velocity data usually varies randomly depending on receiving condition, etc.This random variation may be reduced by smoothing (averaging) the raw data as illustrated below.



The higher the setting, the more smoothed are the raw data.If the setting is too high, speed/course readings delay to change as illustrated below when the actual speed/course have changed.If "0" is entered, smoothing is not performed. Setting "5" is commonly used.



[▽]

NOTE: As explained in NOTE 5 on page 15, the course reading becomes unstable as ship's speed slows down.This is reasonable and can not be prevented.The S/C SMOOTHING setting should be adjusted when the boat is running at the normal speed.

[CLR] [ ] [ ] [ENT] ---- Enter malfunctioning satellite number(s),and you should see it added to the DISABLED SATELLITE list which is presented above the prompt line.

If you want to delete a satellite from the list, enter its number in the same manner.

NOTE: Every GPS satellite is broadcasting the abnormal satellite number(s).By receiving this information, the GP-500 eliminates a malfunctioning satellite from the GPS receiving schedule. When the satellite has restarted normal operation and this information is received, the GP-500 includes it in the schedule. Accordingly it is usually not required to DISABLE a satellite manually.

Sometimes abnormal satellite number is not broadcasted by any satellite. If you learn of an unhealthy satellite through official announcement, etc., deselect it manually. When the satellite has restarted normal operation, do not forget to reselect it because the manually deselected satellite can not be restored automatically.

Abnormal satellites presented on the FUTURE POSITION-FIXING SCHEDULE ([MENU] [7], page 21) are automatically deselected ones. The disabled satellites presented on the INITIAL DATA (2) screen are manually deselected ones.

[▽]

```
  INIT DATA (2)
➡POSITION MODE   = 2 D  (0:2D 1:3D )
 BACKUP NAV
          BUZZER = OFF  (1:ON 2:OFF)
```

[CLR] [ ] [ENT] ---- Select a GPS position-fixing mode between the following two.

[0]: 2D ----- 2-dimensional position-fixing (lat/long only)

[1]: 3D ----- 3-dimensional position-fixing (lat/long plus altitude)

[▽]

NOTE: If the GP-500 is installed on a ship, the 2-D mode is recommended since it offer's longer GPS position-fixing periods.

[CLR] [ ] [ENT]---- A pip is generated three times when GPS fix becomes available or unavaiolable. If this function is not necessary, input [2] to quit.

Selecting a GEODETIC SYSTEM

Various geodetic systems are available in the world. Select a geodetic system in accordance with the one employed in your sea chart. If a wrong geodetic system is selected, a constant difference will be observed between the lat/long readings on the GP-500 and those on the sea chart. This difference may be offset by the LAT/LONG CORRECTION described on page M-10. (Refer to "GEOGRAPHICAL AREA" on page M-35.)

[MENU] [9] [1] [ENT]

```
  DATUM SELECT
→DATUM SELECT      = WGS-84
 DATUM CORECT VAR:   0.000' N   0.000' E

 001:WGS-84 002:WGS-72    003:TOKYO
 004:NAD-27 005:EUROPEAN 006:AUSTRALIAN
 007~:REFER TO OPERATOR'S MANUAL
```

Correction value against the datum selected to WGS-84 will be displayed.

[CLR] [ ] [ ] [ ] [ENT] ---- Enter a 3-digit number given to the desired geodetic system.

In addition to the six geodetic systems presented on the screen, the following ones are also available. You may select them, as well.

```
001: WGS-84
002: WGS-72
003: TOKYO                : Mean Value ( Japan, Korea, and Okinawa )
004: NORTH AMERICAN 1927  : Mean Value (CONUS)
005: EUROPEAN 1950        : Mean Value
006: AUSTRALIAN GEODETIC 1984 : Australia and Tasmania Island
007: ADINDAN              : Mean Value ( Ethiopia and Sudan )
008:                      : Ethiopia
009:                      : Mali
010:                      : Senegal
011:                      : Sudan
012: AFG                  : Somalia
013: AIN EL ABD 1970      : Bahrain Island
014: ANNA 1 ASTRO 1965    : Cocos Island
015: ARC 1950             : Mean Value
016:                      : Botswana
017:                      : Lesotho
018:                      : Malawi
019:                      : Swaziland
020:                      : Zaire
021:                      : Zambia
022:                      : Zimbabwe
023: ARC 1960             : Mean Value ( Kenya, Tanzania)
024:                      : Kenya
025:                      : Tanzania
026: ASCENSION ISLAND 1958  : Ascension Island
027: ASTRO BEACON "E"     : Iwo Jima Island
028: ASTRO B4 SOR. ATOLL  : Tern Island
029: ASTRO POS 714        : St. Helena Island
```



```
030: ASTRONOMIC STATION 1952 : Marcus Island
031: AUSTRALIAN GEODETIC 1966 : Australia and Tasmania Island
032: BELLEVUE ( IGN )     : Efate and Erromango Islands
033: BERMUDA 1957         : Bermuda Islands
034: BOGOTA OBSERVATORY   : Colombia
035: CAMPO INCHAUSPE      : Argentina
036: CANTON ISLAND 1966   : Phoenix Islands
037: CAPE                 : South Africa
038: CAPE CANAVERAL       : Mean Value ( Florida and Bahama Islands )
039: CARTHAGE             : Tunisia
040: CHATHAM 1971         : Chatham Island ( New Zealand )
041: CHUA ASTRO           : Paraguay
042: CORREGO ALEGRE       : Brazil
043: DJAKARTA ( BATAVIA ) : Sumatra Island ( Indonesia )
044: DOS 1968             : Gizo Island ( New Georgia Islands )
045: EASTER ISLANDS 1967  : Easter Island
046: EUROPEAN 1950 (Cont'd) : Western Europe
047:                        : Cyprus
048:                      : Egypt
049:                      : England, Scotland, Channel, and Shetland Islands
050:                      : England, Ireland, Scotland, and Shetland Islands
051:                      : Greece
052:                      : Iran
053:                      : Italy--Sardinia
054:                      : Italy--Sicily
055:                      : Norway and Finland
056:                      : Portugal and Spain
057: EUROPEAN 1979        : Mean Value
058: GANDAJIKA BASE       : Republic of Maldives
059: GEODETIC DATUM 1949  : New Zealand
060: GUAM 1963            : Guam Island
061: GUX 1 ASTRO          : Guadalcanal Island
062: HJORSEY 1955         : Iceland
063: HONG KONG 1963       : Hong kong
064: INDIAN               : Thailand and Vietnam
065:                      : Bangladesh, India, and Nepal
066: IRELAND 1965         : Ireland
067: ISTS 073 ASTRO 1969  : Diego Garcia
068: JHONSTON ISLAND 1961 : Jhonston Island
069: KANDAWALA            : Sri Lanka
070: KERGUELEN ISLAND     : Kerguelen Island
071: KERTAU 1948          : West Malaysia and Singapore
072: LA REUNION           : Mascarene Island
073: L.C. 5 ASTRO         : Cayman Brac Island
074: LIBERIA 1964         : Liberia
075: LUZON                : Philippines  ( Excluding Mindanao Island
076:                      : Mindanao Island
077: MAHE 1971            : Mahe Island
078: MARCO ASTRO          : Salvage Islands
079: MASSAWA              : Eritrea (Ethiopia)
080: MERCHICH             : Morocco
081: MIDWAY ASTRO 1961    : Midway Island
082: MINNA                : Nigeria
083: NAHRWAN              : Masirah Island(Oman)
084:                      : United  Arab Emirates
085:                      : Saudi Arabia
086: NAMIBIA              : Namibia
087: MAPARIMA, BWI        : Trinidad and Tobago
088: NORTH AMERICAN 1972  : Western United States
089:                      : Eastern United States
090:                      : Alaska
091:                      : Bahamas ( Excluding San Salvador Island )
092:                      : Bahamas---San Salvador Island
```

093: NORTH AMERICAN 1927 (Cont'd) : Canada (Including Newfoundland Island
094: : Alberta and British Columbia
095: : East Canada
096: : Manitoba and Ontario
097: : Northwest Territories and Saskatchewan
098: : Yukon
099: NORTH AMERICAN 1927 (Cont'd) : Canal Zone
100: : Caribbean
101: : Cenral America
102: : Cuba
103: : Greenland
104: : Mexico
105: NORTH AMERICAN 1983 : Alaska
106: : Canada
107: : CONUS
108: : Mexico, Central America
109: OBSERVATORIO 1966 : Corvo and Flores Islands (Azores)
110: OLD EGYPTIAN 1930 : Egypt
111: OLD HAWAIIAN : Mean Value
112: : Hawaii
113: : Kauai
114: : Maui
115: : Oahu
116: OMAN : Oman
117: ORDNANCE SURVEY OF GREAT BRITAIN 1936 : Mean Value
118: : England
119: : England, Isle of Man, and Wales
120: : Scotland and Shetland Islands
121: : Wales
122: PICO DE LAS NIVIES : Canary Islands
123: PITCAIRN ASTRO 1967 : Pitcairn Island
124: PROVISIONAL SOUTH CHILEAN 1963 : South Chile (near 53° S)
125: PROVISIONAL SOUTH AMERICAN 1956 : Mean Value
126: : Bolivia
127: : Chile---Northern Chile (near 19° S)
128: : Chile---Southern Chile (near 43° S)
129: : Colombia
130: : Ecuador
131: : Guyana
132: : Peru
133: : Venezuela
134: PUERTO RICO : Puerto Rico and Virgin Islands
135: QATAR NATIONAL : Qatar
136: QORNOQ : South Greenland
137: ROME 1940 : Sardinia Islands
138: SANTA BRAZ : Sao Maguel, Santa Maria Islands (Azores)
139: SANTO (DOS) : Espirito Santo Island
140: SAPPER HILL 1943 : East Falkland Island
141: SOUTH AMERICAN 1969 : Mean Value
142: : Argentina
143: : Bolivia
144: : Brazil
145: : Chile
146: : Colombia
147: : Ecuador
148: : Guyana
149: : Paraguay
150: : Peru
151: : Trinidad and Tobago
152: : Venezuela
153: SOUTH ASIA : Singapore
154: SOUTHEAST BASE : Porto Santo and Madeira Islands
155: SOUTHWEST BASE : Faial, Graciosa, Pico, Sao Jorge, and Terceira Islands

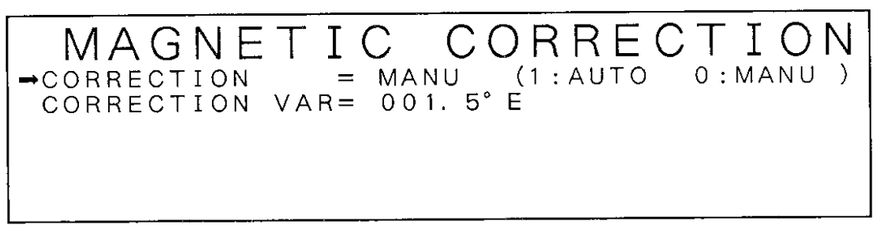
156: TIMBALAI 1948 : Brunei and East Malaysia (Sarawak and Sadah)
157: TOKYO : Japan
158: : Korea
159: : Okinawa
160: TRISTAN ASTRO 1968 : Tristan da Cunha
161: VITI LEVU 1916 : Viti Levu Island (Fiji Islands)
162: WAKE-ENIWETOK 1960 : Marshall Islands
163: ZANDERIJ : Suriname
164: BUKIT RIMPAH : Bangka and Belitung Islands (Indonesia)
165: CAMP AREA ASTRO : Camp Mcmurdo Area, Antarctica
166: G. SEGARA : Kalimantan Islands (Indonesia)
167: HERAT NORTH : Afghanistan
168: HU-TZU-SHAN : Taiwan
169: TANANARIVE OBSERVATORY 1925 : Madagascar
170: YACARE : Uruguay

MAGNETIC CORRECTION

The location of the magnetic north pole is a little deviated from the geographical one.This makes a difference between the true and magnetic north direction. This difference, called a MAGNETIC VARIATION,varies with respect to the observation point on the earth. In order to present magnetic bearings on the screen, read the magnetic variation from your sea chart, and enter it as follows.

Though there are automatic momde and manual mode for magnetic correction, better correction is availlable on manual mode if the precise variation is known.

[MENU] [9] [4]



Automatic Mode

Manual Mode

[CLR] [0] [ENT]

[▽]

[CLR] [ ] [ ] [ ]. [ ]° ([+/–]) [ENT] ------ Enter a MAGNETIC VARIATION by consulting an appropriate sea chart.
E/W

For TRUE BEARING presentation, enter zeroes.

Continued to the next page.

[CLR] [1] [ENT]

The maagnetic correction will be calculated automatically and displays the correction value. The correction value changes according to the sea area and all the direction will be the magnetic.

NOTE: When the magnetic correction is performed, "MAG" is presented on the bottom of the display,indicating that bearings presented on the screen are magnetic bearings.

Selecting DISPLAY UNIT/MODE

[MENU] [9] [5]

```
DISPLAY UNIT
➡LAT•LONG RESL = 0.001   (1:0.01 0:0.001)
 RNG•BRG  CALC = GC      (1:GC   0:RB    )
 RNG•SPD  UNIT = NM   (1:NM  2:KM  3:SM )
 BAR GRAPHIC   = XTE  (1:OFF 2:XTE 3:△C )
 VTD/BRG/RNG   = VTD  (1:VTD 2:BRG 3:RNG)
```

[CLR] [ ] [ENT] ----- Select a LAT•LONG RESOLUTION.

[∇]
- [0]: Resolution = 0.001 min.
- [1]: Resolution = 0.01 min.

[CLR] [ ] [ENT] ---- Select a RANGE BEARING CALCULATION mode.

[∇]
- [1]: Rhumb Line Course
- [0]: Great Circle Course

NOTE: Rhumb line and great circle courses are explained on page 47.

[CLR] [ ] [ENT] ---- Select a RANGE•SPEED UNIT.

[∇]
- [1]: Nautical Mile (NM) = 1852m
- [2]: Kilometer (KM)
- [3]: Statute Mile (SM) = 1609m

[CLR] [ ] [ENT] ---- Select what to show on bargraph. See page 12 (2).

[∇]
- [1]: Turn off the bargraph
- [2]: Show Cross Track Error
- [3]: Show Course Error

[CLR] [ ] [ENT] ---- Select what to show on "NAV. DATA" screen.

- [1]: VTD (Velocity to Destination)
- [2]: BRG (Bearing to TO WP)
- [3]: RNG (Range to TO WP)

Selecting a BACK-UP NAVAID

Select a back-up navaid which should be used when the HDOP goes worse than the HDOP threshold or when satellites have gone.

[MENU] [9] [3]

```
BACK UP NAV SELECT
➡BACK UP NAV      = NNDR
        (1:NONE 2:GPDR 3:NNDR 4:LRN-A
         5:LRN-C 6:OMG 7:DEC  8:II NAV
 GPS POSIT CORECT= YES (1:YES 0:NO )
 GPS COR SMOOTING= 0   (0~9)
 GPS CORECT VAR  :  0.000' N  0.000' E
```

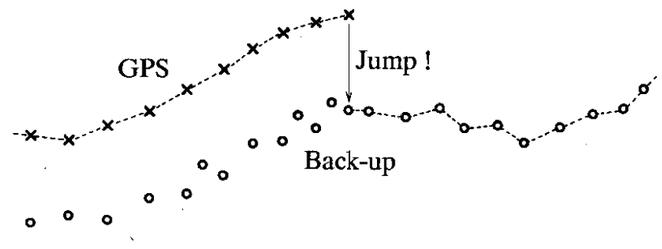
[CLR] [ ] [ENT] ---- Select a BACK-UP NAVAID.

- [1]: NONE ---- Regardless of HDOP value, GPS position-fixing is performed so long as 3 satellites (4 satellites in case of 3-D mode) are available in line of sight. When GPS fix becomes unavailable, the present position reading is frozen.
- [2]: GPDR ---- Backed up by DEAD-RECKONING using the speed/heading data of which the information source is selected on page M-22.
- [3]: NNDR ----Backed up by SATNAV plus DEAD-RECKONING. Note that the dead-reckoning discussed here is the back-up for the satnav.
- [4]: LRN-A --- Backed up by LORAN-A.
- [5]: LRN-C --- Backed up by LORAN-C.
- [6]: OMG ----- Backed up by OMEGA.
- [7]: DEC ------ Backed up by DECCA.

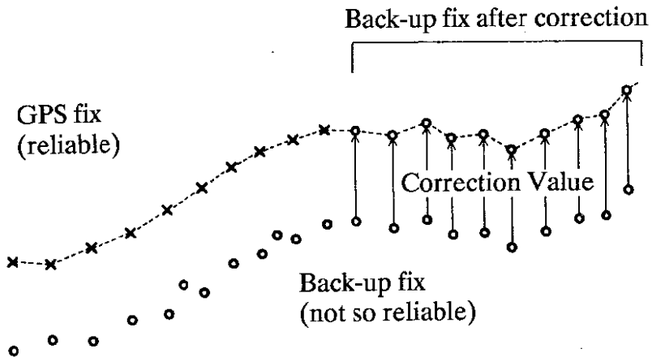
[∇]

[CLR] [ ] [ENT] ---- Enter [1] if you need GPS POSITION CORRECTION.

Usually a constant difference exists between GPS and back-up fixes.This causes a jump of present position at switching from GPS to the back-up navaid as illustrated below.



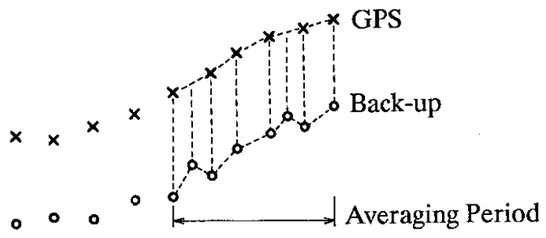
If the HDOP threshold is set low and the GPS fix is thought more reliable than the back-up fix, enter [1] YES. The back-up fix is corrected for better continuity from the GPS fix as illustrated below. Enter [0] NO if you do not need such a correction.



[▽]

[CLR] [ ] [ENT] ---- Enter GPS CORRECTION SMOOTHING.

The correction value (constant) illustrated in the above figure is determined by averaging (smoothing) the differences between the GPS and back-up fixes which are measured shortly before the GPS to Back-up Switching takes place.The parameter entered here determines the averaging period.



If the GPS and/or back-up fix is unstable, use a higher setting for a longer averaging period. Enter zero for no averaging, i.e., the correction value is given as the difference between the last GPS fix and the back-up fix at that moment.

NOTE: GPS correct value will be displayed at the foot of the screen.

Selecting LOG/GYRO DATA

If GPDR is selected as a back-up navaid, or if you need SET/DRIFT presentation, enter speed/heading data through the following operation.

[MENU] [9] [2]

Selecting a sourece of speed information

If neither a speed log nor an external navaid (NMEA 0183) are connected to the GP-500;

If a speed log or ext, navaid (NMEA 0183) is connected,

[CLR] [1] [ENT] ---- Select [1] MODE = AUTO.

```
LOG・GYRO DATA                (▼:GYRO )
➡LOG      = AUTO      (1:AUTO   0:MANUAL)
 SPD      = LOG       (1:LOG    0:NMEA   )
 LOG IN   = CONTACT   (1:CONTACT 0:TTL   )
 LOG PULSE(IN)  =      200P/NM  (100~500P/NM)
                                (9000~30000P/NM)
 LOG PULSE(OUT) =     200P/NM  (0~500P/NM)
```

[▽]

[▽]

[CLR] [ ] [ENT] ---- Select a SPEED data source between [0] NMEA 0183 and [1] LOG.

If speed data (VHW) is sent from the external navaid which is connected to the DATA IN or DATA IN/OUT connector, you may use it for dead-reckoning.**

[▽]

[CLR] [ ] [ENT] ------ Select a LOG IN signal mode ([0]: TTL level signal or [1]: contact closure signal) if LOG is selected in the preceding step.

[▽]

[CLR] [ ] [ ] [ ] [ ] [ ] [ENT] ------- Enter a LOG PULSE (IN) rate if LOG is selected as a speed data source.

[▽]

(Enter a pulses/nm ratio between 00100 and 00500 or between 09000 and 30000.)

[CLR] [0] [ENT] ---- Select [0] MODE = MANUAL.

```
  LOG・GYRO  DATA          (▼:GYRO )
➡LOG      = AUTO      (1:AUTO  0:MANUAL)
 SPD      = NMEA      (1:LOG   0:NMEA  )
 LOG IN = CONTACT  (1:CONTACT 0:TTL )
 LOG PULSE(IN) =   200P/NM  (100~500P/NM)
                            (9000~30000P/NM)
 LOG PULSE(OUT) =  200P/NM  (0~500P/NM)
```

[∇]

[CLR] [ ] [ ]. [ ] [ENT] ------ Enter a SPEED (estimated speed or speed log reading if available). Re-enter a speed whenever the ship's speed has changed.

[∇]
[∇]
[∇]

[CLR] [ ] [ ] [ ] [ENT] ---- Enter a LOG PULSE (OUT) rate. (Pulses/nm)

The GP-500 outputs a contact closure signal which represents ship's speed.During the GPS position-fixing operation, the signal is output based on the speed data which is measured by receiving satellites. During the back-up period, it is output based on the speed information which is obtained from the back-up navaid including dead reckoning. If zero is entered here, a pulse is not output.

[∇]

Selecting a sourse of heading information

If neither gyrocompass nor external navaid (NMEA 0183) are connected to the GP-500;

If a gyrocompass or ext. navaid (NMEA 0183) is connected;

[CLR] [1] [ENT] ---- Select [1] MODE = AUTO.

```
  LOG・GYRO  DATA          (▲:LOG  )
 GYRO     = AUTO      (1:AUTO  0:MANUAL)
➡HDG      = GYRO      (1:GYRO  0:NMEA  )

 SET/DFT SMOOTHING = 0  (0~9)
```

[∇]

[CLR] [ ] [ENT] ------ Select a HEADING data source between [1] GYROCOMPASS and [0] NMEA 0183.

If a heading data (VHW) is sent from the external navaid which is connected to the DATA IN or DATA IN/OUT connector, you may use it for dead-reckoning.**

[CLR] [0] [ENT] ---- Select [0] MODE = MANUAL.

```
  LOG・GYRO  DATA          (▲:LOG  )
➡GYRO     = MANUAL    (1:AUTO  0:MANUAL)
 HDG      = 123.3°

 SET/DFT SMOOTHING = 0  (0~9)
```

[∇]

[CLR] [ ] [ ] [ ]. [ ] [ENT] -- Enter a HEADING (compass reading). Re-enter it whenever the ship's course has changed.

[∇]

[CLR] [ ] [ENT] ---- Enter a SET/DRIFT SMOOTHING.

Set/drift readings may be smoothed. Setting "5" is commonly used. Increase the setting if the readings are unstable, and decrease it if the response is too slow.

NOTE: For the same reason as the NOTE on page M-11, the SET/DRIFT SMOOTHING setting should be adjusted when the boat is running at the normal speed.

Selecting COMMUNICATION FORMATS (for technicians only)

You may select communication formats for the [DATA IN], [DATA OUT], and [DATA IN/OUT] connectors, respectively.

NOTE: 1. When selecting the formats/sentences below, confirm that the connected equipments can handle them.

2. Read "Notes on CABLING" described on page AP-10, too.

Setting for DATA IN Connector

This connector is usually used for a back-up navaid. (Reception only)

NOTE: Although the connector is named "DATA IN", output for an autopilot is also available. More on this later.

[MENU] [9] [9] [0]

```
DATA IN CONNECTOR
→FORMAT = CIF      (1:NMEA   0:CIF   )
```

[CLR] [ ] [ENT] ---- Select a FORMAT between [0] FURUNO CIF and [1] NMEA 0183.

The following sentences can be received through this connector.

FURUNO CIF ----- Present lat/long
Speed/course

NMEA 0183 -------- **GLL (Present lat/long)
**VHW (Heading/Water-tracking Speed)
**VTG (Course/Ground-tracking Speed)

*NOTE 1. **Any Talker*

*2. **VHW is required when GPDR is selected as a back-up navaid (page M-20) and NMEA 0183 is selected as a speed/heading information source (page M-22).*

Setting for DATA OUT Connector

Usually a display device such as plotter or color sounder is tied to this connector. (Transmission only)

NOTE: Output for an autopilot is also available on this connector. More on this later.

[MENU] [9] [9] [1]

In case of NMEA 0183;

In case of FURUNO CIF;

[CLR] [0] [ENT] ---- Select [0] FORMAT = FURUNO CIF.

```
DATA OUT CONNECTOR
→FORMAT = CIF      (1:NMEA   0:CIF   )
 OUT DAT= L/L:023  R/B:60   S/C:001  HGT:01
 DATA CHANGE       =  --  (0:--  1:DR  2:LA
                          3:LC  4:OM  5:DC )
 GPS DATA OUT      = ON   (1:ON  0:OFF )
 GPS ERR CODE OUT  = OFF  (1:ON  0:OFF )
```

[▽]

[CLR] [ ][ ] [ ][ ] [ ][ ] [ ][ ] [ENT]
L/L R/B S/C HGT

Enter transmitting INTERVAL (00 to 60 seconds) for each of the following sentences. Enter "00" if you do not need transmission. The above screen shows the default settings.

L/L .....Present lat/long
R/B .....Range/bearing of TO WAYPOINT observed from present position
S/C .....Speed/course
HGT .....Altitude obtaind by 3-dimensional position-fixing

[▽]

[CLR] [ ] [ENT] ---- Select a dummy navaid for DATA CHANGE.

As the sentence format for GPS fix was developed rather recently, some old equipment can not receive it. In such a case, both GPS and back-up fixes may be transmitted in the format of a conventional navaid. Select a navaid for data (format) change.

NOTE: If you do not need transmission with a dummy format, select [0].

[0]: – – . . .No transmission with a dummy format.
[1]: DR . . .Lat/long data is transmitted as SATNAV fix.
[2]: LA . . .Lat/long data is transmitted as LORAN-A fix.
[3]: LC . . .Lat/long data is transmitted as LORAN-C fix.
[4]: OM . .Lat/long data is transmitted as OMEGA fix.
[5]: DC . . .Lat/long data is transmitted as DECCA fix.

[∇]

[CLR] [ ] [ENT] ---- Select [1] YES if you need GPS DATA OUT.

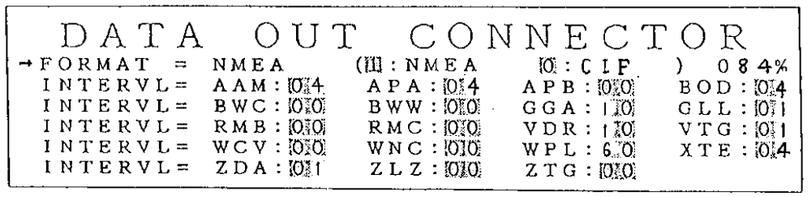
If [1] is entered, both GPS and back-up fixes are transmitted in GPS format in addition to the dummy selected in the preceding step. If you need GPS-format data only, enter [0] in the preceding step and [1] in this step.

[∇]

[CLR] [ ] [ENT] ---- Select [1] YES if you need GPS ERR CODE OUT.

If [1] YES is selected, back-up fix is transmitted with a GPS error code always attached. If [0] NO is selected, the original error code from the back-up navaid is transmitted as it is. Usually select [0] GPS ERR CODE OUT = OFF.

[CLR] [1] [ENT] ---- Select [1] FORMAT = NMEA 0183.


DATA OUT CONNECTOR
→FORMAT = NMEA (1:NMEA 0:CIF) 084%
INTERVL= AAM:04 APA:04 APB:00 BOD:04
INTERVL= BWC:00 BWW:00 GGA:10 GLL:01
INTERVL= RMB:00 RMC:00 VDR:10 VTG:01
INTERVL= WCV:00 WNC:00 WPL:60 XTE:04
INTERVL= ZDA:01 ZLZ:00 ZTG:00

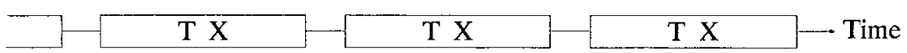
[∇]

[CLR] [ ][ ] [ ][ ] [ ][ ] [ ][ ] [ENT]

Enter transmitting INTERVAL (00, 01, 02, 03, 04, 05, 10, 12, 15, 20, 30, 40, 50, or 60 seconds) for each sentence. Enter "00" if you do not need transmission. The above screen shows the default settings.

RATE OF OPERATION

In order to send out the sentences with the above-speified intervals, the transmitter must be operated at the rate indicated in percentage. 000% means no transmission, and 100% does continuous transmission. If short intervals are assigned to many sentences, the rate of operation increases as illustrated below.



Rate of operation exceeding 100% is impractical. It is requested to adjust the transmitting intervals so that the rate of operation does not exceed the default one, 84%.

NOTE: 1. During the back-up periods, sentences are transmitted with talker ID "GP", but error flags in the sentences (such as APA, XTE) are asserted, in order to indicate that the data are not obtained by GPS reception. If speed/course information from an external navaid (NMEA 0183) is used for Dead Reckoning, data obtained by dead reckoning are output during the back-up periods.

2. As GPS is a new system, some old equipment can not receive a sentence with talker name "GP". In such a case, both GPS and back-up fix data may be transmitted with a talker name of a conventional navaid instead of GP. Follow the instruction below.

(a) Temporarily select the CIF format as described on page M-26,and select a talker name for DATA CHANGE among the following six.

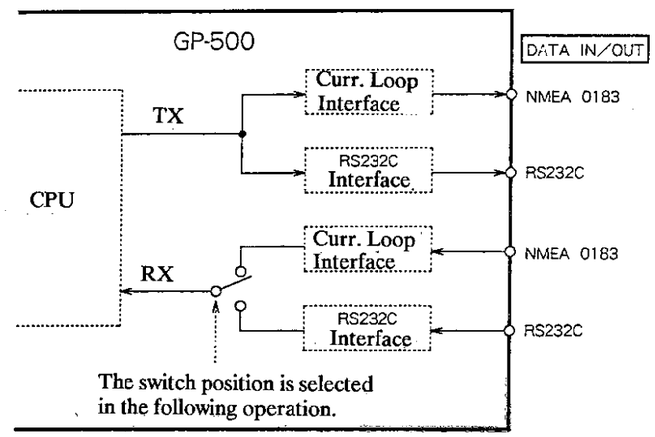
Entry	Talker Name
[0] "- - -"	GP (Talker Name is not changed.)
[1] "DR"	TR (Transit or Satnav)
[2] "LA"	LA (Loran A)
[3] "LC"	LC (Loran C)
[4] "OM"	OM (Omega)
[5] "DC"	DE (Decca)

(b) Select the NMEA0183 format.

If you need not change the talker name, temporarily select the CIF format and confirm that [0] "- - -" is selected.

Setting for DATA IN/OUT Connector

This connector can input/output NMEA 0183 format data. A back-up navaid, an autopilot, or a display device such as plotter or color sounder may be connected. Transmission signal is output simultaneously with both NMEA/FURUNO CIF-compatible current-loop and RS232C level from respective pins. As for input signals, current-loop and RS232C level signals are received at the respective pins, but either one input can be fetched by the CPU as illustrated below.



[MENU] [9] [2]

```
D. IN/OUT CONNECTOR
→FORMAT = NMEA     (1:RS232C 0:NMEA )  084%
 INTERVL= AAM:04   APA:04   APB:00   BOD:04
 INTERVL= BWC:00   BWW:00   GGA:10   GLL:01
 INTERVL= RMB:00   RMC:00   VDR:10   VTG:01
 INTERVL= WCV:00   WNC:00   WPL:60   XTE:04
 INTERVL= ZDA:01   ZLZ:00   ZTG:00
```

[CLR] [ ] [ENT] ------ Select an electrical FORMAT of receiving data between [1] RS232C and [0] NMEA (current loop).

NOTE: • *This connector can receive the same NMEA 0183 sentences as the DATA IN CONNECTOR described on page M-25.*

• *When data are received from both DATA IN and DATA IN/OUT connectors, the one from DATA IN/OUT is totally disregarded.*

[▽]

[CLR] [ ][ ] [ ][ ] [ ][ ] [ ][ ] [ENT]

Enter transmitting INTERVAL (00, 01, 02, 03, 04, 05, 10, 12, 15, 20, 30, 40, 50, or 60 seconds) for each sentence. Enter "00" if you do not need transmission. The screen on the preceding page shows the default settings.

It is requested to adjust the transmission intervals so that the rate of operation (the percentage presented at the top right corner of the screen) does not exceed 84%.

NOTE: 1. All sentences are transmitted with talker ID "GP".

2. During the back-up periods, sentences are transmitted with talker ID "GP", but error flags in the sentences (such as APA, XTE) are asserted in order to indicate that the data are not obtained by GPS reception. If speed/course information from an external navaid (NMEA 0183) is used for Dead Reckoning, data obtained by dead reckoning are output during the back-up periods.

3. RS232C is the standard for data communication. It mainly specifies electrical characteristics of signals and some handshake controls for data exchange. Sentence be prepared at the external equipment side (personal computer, etc.) The DTR output is asserted continually; the DSR input is not available.

Setting for AUTOPILOT Connection

The DATA OUT Connector Pin #3 and #4 are intended for autopilot connection. As these pins are tied to the DATA IN/OUT Connector Pin #3 and #4 internally, you may use either connector.

[MENU] [9] [9] [3]

In case of NMEA 0180

In case of NMEA 0183

[CLR] [1] [ENT] ---- Select [1] FORMAT = NMEA 0183

[▽]

```
AUTO PILOT DATA
→FORMAT = 183  (1:NMEA183 0:NMEA180)  028%
 INTERVL= AAM:04   APA:00   APB:00   BOD:04
 INTERVL= BWC:00   BWW:00   GGA:00   GLL:00
 INTERVL= RMB:00   RMC:00   VDR:00   VTG:04
 INTERVL= WCV:00   WNC:00   WPL:00   XTE:04
 INTERVL= ZDA:00   ZLZ:00   ZTG:00
```

[CLR] [ ][ ] [ ][ ] [ ][ ] [ ][ ] [ENT]

Enter transmitting INTERVAL (00, 01, 02, 03, 04, 05, 10, 12, 15, 20, 30, 40, 50, or 60 seconds) for each sentence. Enter "00" if you do not need transmission. The above screen shows the default settings intended for Furuno's Autopilots FAP-50/55.

It is requested to adjust the transmitting intervals so that the rate of operation (the percentage presented at the top right corner of the screen) does not exceed 84%.

NOTE: 1. All sentences are transmitted with talker ID "GP".

2. During the back-up periods, sentences are transmitted with talker ID "GP", but error flags in the sentences (such as APA, XTE) are asserted in order to indicate that the data are not obtained by GPS reception. If speed/course information from an external navaid (NMEA 0183) is used for Dead Reckoning, data obtained by dead reckoning are output during the back-up periods.

[CLR] [0] [ENT] ---- Select [0] FORMAT = NMEA 0180

[▽]

```
AUTO PILOT DATA
→FORMAT = 180  (1:NMEA183 0:NMEA180)
 INTERVL= XTE:01  (01~05)
```

[CLR] [ ] [ ] [ENT] ------ Enter transmitting INTERVAL (01 to 05 seconds).

DEFAULT Settings

The default settings after the ALL CLEAR operation (page M-5) are as follows. The unit is shipped from the factory with these settings.

[MENU]

- [0]: INITIAL DATA (1)
  - Mon/Day/Year = * */* */* *
  - Time = * * : * *' * *"
  - Local Zone Time = + 0 0 H 0 0 M

  } GMT is set.

  - Latitude = 38° 0 0. 0 0' N
  - Longitude = 123° 0 0. 0 0' W

  } San Francisco,USA.

  - HDOP Threshold = 2 0
- [9]: SYSTEM DATA MENU
  - [0]: INITIAL DATA (2)
    - Antenna Height = 0 0 0 0 M
    - L/L Correction = 0.0 0 0' N 0.0 0 0' E
    - L/L Smoothing = 0
    - S/C Smoothing = 5
    - Disable Satellites = none
    - Position Mode = 2D
  - [1]: DATUM SELECT
    - Datum Select = WGS-84
  - [2]: LOG · GYRO DATA
    - Log Mode = AUTO
    - Speed = LOG
    - Log In = CONTACT
    - Log Pulse (In) = 0 0 2 0 0 P/NM
    - Log Pulse (Out) = 0 0 0 0 P/NM
    - Gyro Mode = AUTO
    - Heading = GYRO
    - Set/Drift Smoothing = 5
  - [3]: BACK UP NAVAID SELECT
    - Back-up Navaid = none
    - GPS Position Correction = NO
    - Smoothing = 9
  - [4]: MAGNETIC CORRECTION
    - Correction = MANUAL
    - Correction Variation = 0 0 0. 0° E
  - [5]: DISPLAY UNIT
    - Lat/long Resolution = 0. 0 0 1'
    - RangeBearing Calculation = GREAT CIRCLE
    - RangeSpeed Unit = NM
    - Graphic XTE = presented
  - [9]: I/O DATA FORMAT
    - [0]: DATA IN CONNECTOR
      - Format = CIF
    - [1]: DATA OUT CONNECTOR
      - Format = CIF
        - Out Data = L/L:01 R/B:60 S/C:01 HGT:01
        - Data change = no
        - GPS Data Out = ON
        - GPS Error Code Out = OFF
      - Format = NMEA
        - Interval = AAM:04 APA:04 BOD:04 GGA:10 GLL:01 VDR:10 VTG:01 WPL:60 XTE:04 ZDA:01
    - [2]: DATA IN/OUT CONNECTOR
      - Format = NMEA
      - Interval = AAM:04 APA:04 BOD:04 GGA:10 GLL:01 VDR:10 VTG:01 WPL:60 XTE:04 ZDA:01
    - [3]: AUTOPILOT DATA
      - Format = 183
        - Interval = AAM:04 BOD:04 VTG:04 XTE:04
      - Format = 180
        - interval = XTE:01

PARAMETER

Q & A

This chapter provides user-level troubleshooting procedures for the troubles which are mainly caused by the misuse of the equipment.

[Symptom 1] No satellite reception/No position fixing

(1) Is the PRESENT POSITION (page 11) reasonable?

If the error is larger than ten degrees, reenter the INITIAL LAT/LONG as explained on page 10.

(2) Isn't the HDOP THRESHOLD (page M-9) set too low?

Too low a setting, such as 1, causes extremely short position fixing periods.

(3) Perform the SELF-TEST described on page M-2. Are the test results ok?

NOTE 1. If "AMP: ● " is presented, check the cable connection on the ANTENNA connector which is located on the rear panel.

2. Disregard the test results of the communication interfaces described on page M-3. "0" is presented unless the jumper leads are connected.

3. If the other error is diagnosed, call for repair.

(4) Are the PRESENT DATE/TIME (page 11) reasonable?

If not, reenter them as follows.

A. Turn the power off, and unplug the cable from the ANTENNA connector.

B. Turn the power on, and enter the DATE/TIME as explained on page M-8.

C. Turn the power off, and reconnect the antenna cable.

(5) Call up the COLD START screen (page M-6). Isn't the ALMANAC DATE older than 6 months ago?

If so, perform the COLD START.

(6) Call up the SV CONDITION screen (page M-1). Ask another boat having a GPS receiver to call up the similar screen. If there is a significant discrepancy between the two, the Almanac in your GP-500 should be faulty. Perform the COLD START explained on page M-6.

[Symptom 2] Position fixing periods are shorter when compared with other ship's GPS.

(1) Isn't the HDOP THRESHOLD (page M-9) set too low?

(2) Aren't healthy satellites DISABLEd (page M-11) by mistake.

(3) Isn't the sight from the GPS antenna obstructed by a mast, funnel, etc ?

Isn't the GPS antenna close to the INAMRSAT antenna? During the 2-D or 3-D period, transmit the INMARSAT. Doesn't the sign change to INT? If it does, GPS reception is interfered.

[Symptom 3] DRIFT/SET readings (page 16) are unreasonable/unstable.

The DRIFT/SET are calculated as a difference between the SPEED/COURSE (page 14) and the LOG/GYRO (page 16) readings.

(1) Are LOG/GYRO readings ok?

(2) Are SPEED/COURSE readings ok?

In the following cases, the SPEED/COURSE and as a result the DRIFT/SET fluctuate. This is reasonable, and your GP-500 is not faulty.

- Ship's speed is deadly slow.
- HDOP (page 21) is high, "20" for example.
- Ship is pitching/rolling. (Pitching/rolling speeds are measured in addition to ship's cruising speed.)

GEOGRAPHIC AREA

A nautical chart is usually made by either trigonometrical survey or astronomical survey and according to the geodetic chart standards of the country it is used in. For example, the U.S.A. uses the system called "Clarke," India, "Everest," and Japan, "Bessel." Accordingly when you are getting position fixes by Loran C or NNSS in the U.S.A., the system should be Clarke so that you don't get a position fix which shows you're somewhere offshore when you're actually moored to a dock.

While the use of one category of chart system is fine if you don't do transoceanic voyages, ocean-going vessels may require all categories to get reliable position information. To solve this inconvenience, a standard chart system was adopted for Loran C and NNSS: the WGS-72.

Although the WGS-72 system is now widely used the other categories of charts still exist. Thus it is necessary to apply a correction value to the WGS-72 to match it to local geodetic systems. Below is the formula for calculation of correction value.

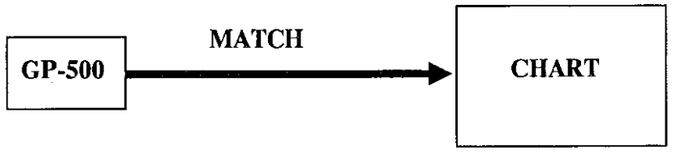
Position Fix by Loran C, NNSS
+) Correction Value
L/L on Chart

For the GPS, the standard system is the WGS-84. Similar to the WGS-72, a correction must be added to the WGS-84 to adjust it for use with local geodetic systems. This unit can perform this calculation automatically if you tell it what type of chart you're using, by following the procedure described on page M-13. For Clarke charts, for example, select 004 (North America 1927). Select the chart system used, not the area where the boat is sailing. Switch the selection only when the chart system used changes.

For charts which you don't know their geodetic system, there is no automatic ocrrection. By observing the position fix carefully however you can calculate how much the error is, and input it as described on page M-10. As this value changes with area adjust it periodically when making long voyages.

boat is sailing far away from the U.S.A, leave it on [004] unless the chart is US chart. Only switch the geodesical system when the system chart adopted change. The system selected on page M-13 depends on the system that the chart adopted, not the area where the boat is sailing.

Select geodetical system chart adopted
[MENU] [9] [1]



PARAMETER

SPECIFICATIONS OF GP-500

RECEIVER CHARACTERISTICS

1. Receive Channel
2 Channels (up to 5 satellites multiplex-tracked)
2. Receiver
L_1, C/A code
3. *Position Accuracy
Better than 15 m rms (HDOP ≤ 3)
4. *Velocity Accuracy
0.1 knots rms (HDOP ≤ 3)
5. Tracking Velocity
100 knots

**Accuracy expected on the current satellites' status. GPS accuracy is subject to change in accordance with the policy of the US Government.*

PROCESSOR/DISPLAY CHARACTERISTICS

1. Display
240 × 64 dot matrix super-twist LCD display (Backlighted)
2. Date/Time
Date, Hour, Minute, Second in GMT or Local
3. Waypoints
Total 100 (Each wpt identified by up to 8 alphanumerics)
4. Memory of Event positions
20 max. points (L/L and date/time)
5. Voyage Plan
(1) Waypoint Navigation: you can select any one waypoint as a destination, range/bearing to the destination are shown digitally.
(2) Routing Navigation: you can register up to 10 routes, each of which is configured with up to 10 wpts selected by user or calculated on great circle.
6. Alarms (Audio-visual)
(1) Cross Track Error or Approach to Border
(2) Arrival or Anchor Watch
8. Gyro/Log Interface
(1) Gyro: Data through AD-10S
(2) Log: 100 - 500 pulses/mile or 9,000 - 30,000 pulses/mile (Impeller Log)
7. Data Interface
(1) Output in FURUNO Standard format CIF
(2) Input in FURUNO Standard format CIF
(3) Output or input in NMEA 0183 format (NMEA level or RS-232C level, selected by listener)
(1) or (2) can be used to output NAV signal (either in NMEA 0180 simplex or 0183format) for Autopilot FAP-50

POWER SUPPLY

- 10-40 VDC, 18 W approx.
- 110/220 VAC, 50-60Hz, 26 VA approx. w/optional rectifier PR-62

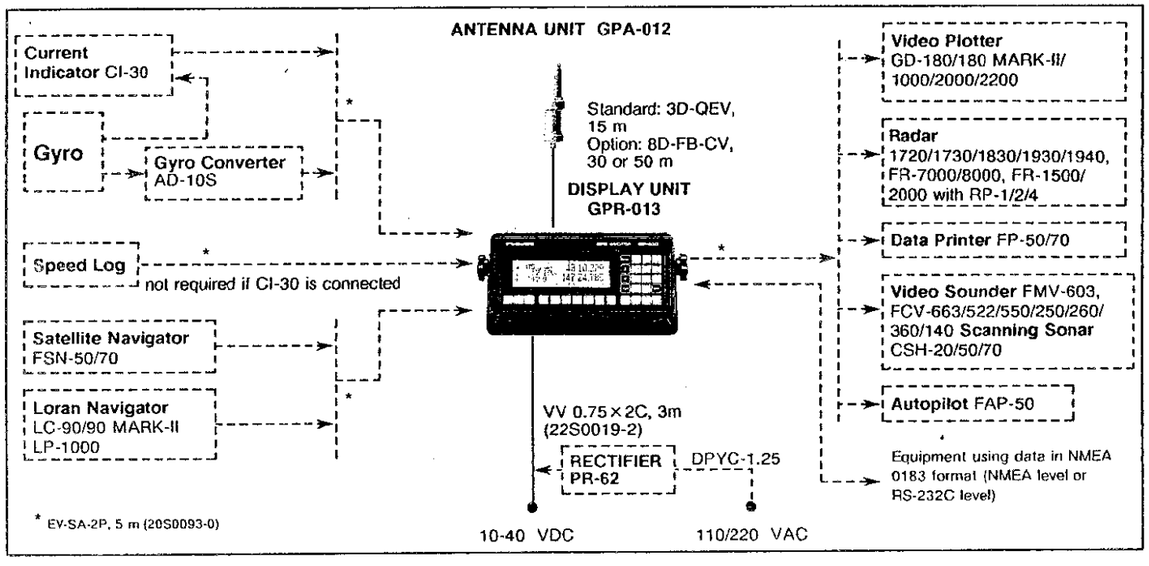
EQUIPMENT LIST

Standard

1. Display Unit GPR-013	1 unit
2. Antenna Unit GPA-012 w/15 m ant. cable	1 unit
3. Installation Materials and Standard Spare Parts	1 set

Optional
1. Rectifier PR-62 for 110/220 VAC supply
2. Ant. Cable Set CP20-00280 (30m) or CP20-00290 (50m) (Armored type)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

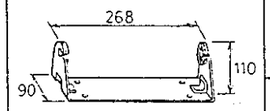
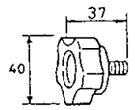
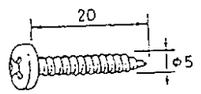
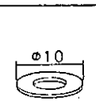
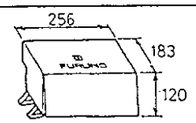

ANTENNA UNIT GPA-012
Current Indicator CI-30
Gyro
Gyro Converter AD-10S
Speed Log
not required if CI-30 is connected
Satellite Navigator FSN-50/70
Loran Navigator LC-90/90 MARK-II LP-1000
Standard: 3D-QEV, 15 m
Option: 8D-FB-CV, 30 or 50 m
DISPLAY UNIT GPR-013
VV 0.75×2C, 3m (22S0019-2)
RECTIFIER PR-62
DPYC-1.25
10-40 VDC
110/220 VAC
* EV-SA-2P, 5 m (20S0093-0)
Video Plotter GD-180/180 MARK-II/ 1000/2000/2200
Radar 1720/1730/1830/1930/1940, FR-7000/8000, FR-1500/ 2000 with RP-1/2/4
Data Printer FP-50/70
Video Sounder FMV-603, FCV-663/522/550/250/260/ 360/140 Scanning Sonar CSH-20/50/70
Autopilot FAP-50
Equipment using data in NMEA 0183 format (NMEA level or RS-232C level)

FURUNO

CODE No.	000-040-153	20AB-X-9501
TYPE	FP20-00200	

工事材料表 INSTALLATION MATERIALS	GP-500	GPS航法装置 GPS NAVIGATOR	

004-362-050
FP20-00220

番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	ハンガー組品 HANGER BRACKET ASSY.		FP20-00210 CODE No. 004-362-040	1	
2	ノブボルト KNOB BOLT ASSY.		KG-B2 M8 × 20 SUS CODE No. 000-800-601	2	
3	小型丸平座金 FLAT WASHER		M8 SUS304 CODE No. 000-800-917	2	
4	⊕ナベタッピンUIネジ TAPPING SCREW		5 × 20 SUS304 CODE No. 000-800-488	4	
5	磨き平座金 FLAT WASHER		M5 SUS304 CODE No. 000-864-128	4	
6	ビニールカバー VINYL COVER		20-004-2301 CODE No. 000-801-903	1	
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		

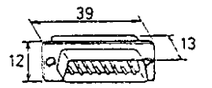
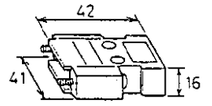
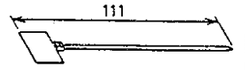
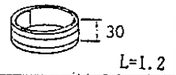
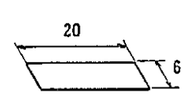
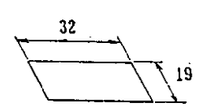
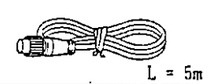
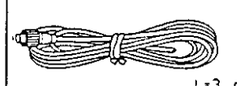
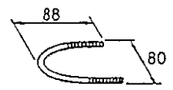
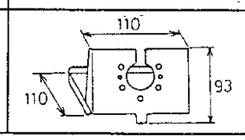
図番 DWG. No.	C4312-M05-A	
検図 CHECKED		

FURUNO

CODE No.	000-040-152	20AB-X-9403-1
TYPE	CP20-00230	

工事材料表 INSTALLATION MATERIALS	GP-500	GPS航法装置 GPS NAVIGATOR	

004-362-080
CP20-00261
(NO.1 ~ 6)

番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	Dサブコネクタ D-SUB CONNCTOR		XM2A-1501 CODE No. 000-111-706	1	受信部用 FOR MAIN UNIT
2	Dサブコネクタフード D-SUB CONNCTOR		XM2S-1513 CODE No. 000-118-820	1	受信部用 FOR MAIN UNIT
3	ケーブルバンド CABLE CLAMP		PLF1M-M CODE No. 000-116-921	5	受信部用 FOR MAIN UNIT
4	アース銅板 COPPER STRAP		04S40801 30×1200×0.3 CODE No. 000-572-187	1	受信部用 FOR MAIN UNIT
5	ヒューズ貼りマーク LABEL		20-004-8002-0 CODE No. 100-114-610	1	受信部用 FOR MAIN UNIT
6	ケーブル貼りマーク LABEL		20-004-8003-0 CODE No. 100-114-820	1	受信部用 FOR MAIN UNIT
7	信号ケーブル組品 SIGNAL CABLE ASSY.		MJ型 6芯ケーブル付コネクタ CODE No. 000-117-603	4	受信部用 FOR MAIN UNIT
8	電源コード POWER CABLE		22S0019-2 CODE No. 000-109-000	1	受信部用 FOR MAIN UNIT
* 9	カブラ用Uボルト U-BULT		04-018-4105 CODE No. 100-025-860	2	空中線部用 FOR ANT. UNIT
* 10	アンテナブラケット ANTENNA BRACKET		20-002-2102-4 CODE No. 100-079-234	1	空中線部用 FOR ANT. UNIT

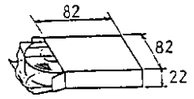
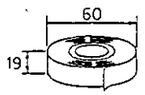
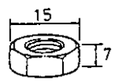
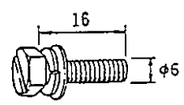
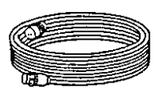
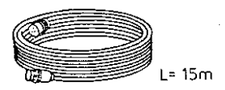
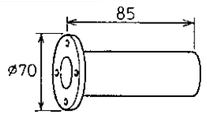
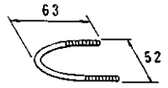
* Not provided for the U.S. export version.

図番 DWG. No.	C4312-M01-B (改)	1/2
検図 CHECKED		

FURUNO

CODE No.	000-040-152	20AB-X-9404-1
TYPE	CP20-00230	

工事材料表 INSTALLATION MATERIALS	GP-500	GPS航法装置 GPS NAVIGATOR	

番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
11	絶縁テープ SELF BONDING TAPE		Uテープ 0.5 × 19 × 5M CODE No. 000-800-985	1	空中線部用 FOR ANT. UNIT
12	ビニールテープ NO.360 VINYL TAPE		0.2 × 19 × 10000 黒 エスロン CODE No. 000-835-215	1	空中線部用 FOR ANT. UNIT
* 13	六角ナット 1種 HEX. NUT		M8 SUS304 CODE No. 000-863-110	4	空中線部用 FOR ANT. UNIT
* 14	バネ座金 SPRING WASHER		M8 SUS304 CODE No. 000-864-262	4	空中線部用 FOR ANT. UNIT
15	六角セムスBスリ割 HEX. BOLT (SLOTTED, WASHER HEAD)		M6×16 SUS304 CODE No. 000-882-061	4	空中線部用 FOR ANT. UNIT
* 16	アンテナケーブル組品 ANTENNA CABLE ASSY.		20S0105-0 CODE No. 000-117-598	1	空中線部用 FOR ANT. UNIT
** 17	O リング O-RING		JISB2401-1A-G35 CODE No. 000-851-303	1	空中線部用 FOR ANT. UNIT
** 18	アンテナケーブル組品 ANTENNA CABLE ASSY.		20S0105-0 CODE No. 000-117-598	1	空中線部用 FOR ANT. UNIT
** 19	A 取付金具 ANTENNA MOUNTING BASE		20-002-2103 CODE No. 100-127-480	1	空中線部用 FOR ANT. UNIT
* 20	ブラケットUボルト U-BOLT		20-002-2104 CODE No. 100-129-220	2	空中線部用 FOR ANT. UNIT

* Not provided for the U.S. export version.
** For the U.S. export version only.

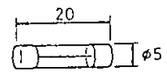
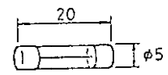
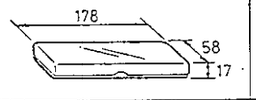
図番 DWG. No.	C4312-M02-B 改	2/2
検図 CHECKED		

FURUNO ELECTRIC CO., LTD.

FURUNO

CODE No.	000-040-150	BOX No. P
TYPE	SP20-00200	

SHIP No.	SPARE PARTS LIST FOR GP-500 GPS 航法装置 GPS NAVIGATOR	USE	SETS PER VESSEL

ITEM No.	NAME OF PART	OUTLINE	DWG. No. OR TYPE No.	QUANTITY WORKING PER SET	QUANTITY WORKING PER VES.	QUANTITY SPARE	REMARKS/CODE No.
1	ミゼットヒューズ FUSE		FGMB 2A AC125V OR GMA-J 2A 125V			3	For 32V 000-103-165
2	ミゼットヒューズ FUSE		FGMB 3A AC 125V OR GMA-J 3A 125V			3	For 12/24V 000-104-909
	予備品箱 SPARE PARTS BOX		FOR F710 用		1		000-831-610

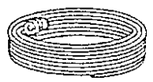
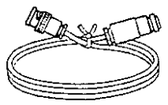
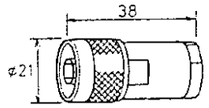
MFR'S NAME	FURUNO ELECTRIC CO., LTD.	DWG. No.	C4312-P01-A

オプション OPTIONAL

FURUNO

CODE No.	000-040-154	20AB-X-9405-1
TYPE	CP20-00280	

工事材料表 INSTALLATION MATERIALS	GP-500 アンテナケーブルセット	GPS航法装置 GPS NAVIGATOR ANTENNA CABLE SET (30M)	

番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	アンテナケーブル組品 ANTENNA CABLE ASSY.	 L=30m	8D-FBCV * 30M * CODE No. 000-111-547	1	
2	アンテナケーブル組品 ANTENNA CABLE ASSY.	 L=1m	20S0106-0 CODE No. 000-117-602	1	
3	同軸コネクタ COAX. CONNECTOR	 38 φ21	N-P-8DFB CODE No. 000-111-549	1	
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		

004-362-590
CP20-00281

図番 DWG. No. C4312-M07-B	
検図 CHECKED	

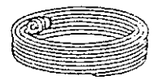
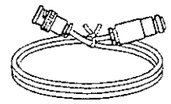
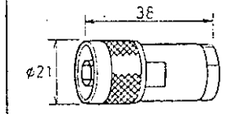
FURUNO ELECTRIC CO., LTD.

オプション OPTIONAL

FURUNO

CODE No.	000-040-155	20AB-X-9406-1
TYPE	CP20-00290	

工事材料表 INSTALLATION MATERIALS	GP-500 アンテナケーブルセット	GPS航法装置 GPS NAVIGATOR ANTENNA CABLE SET (50M)	

番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	アンテナケーブル組品 ANTENNA CABLE ASSY.	 L=50m	8D-FBCV * 50M * CODE No. 000-117-599	1	
2	アンテナケーブル組品 ANTENNA CABLE ASSY.	 L=1m	20S0106-0 CODE No. 000-117-602	1	
3	同軸コネクタ COAX. CONNECTOR	 38 φ21	N-P-8DFB CODE No. 000-111-549	1	
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		
			CODE No.		

図番 DWG. No. C4312-M06-B	
検図 CHECKED	

FURUNO ELECTRIC CO., LTD.

INSTALLATION

This chapter describes various notes which should be excercised when mounting the antenna/display units and connecting cables. When the installation is completed, proceed to the PARAMETER SETTING AFTER INSTALLATION starting from page M-8.

Notes on MOUNTING

ANTENNA UNIT

1. Avoid the places where line-of-sight is easily obstructed by ship's mast, funnel, etc.

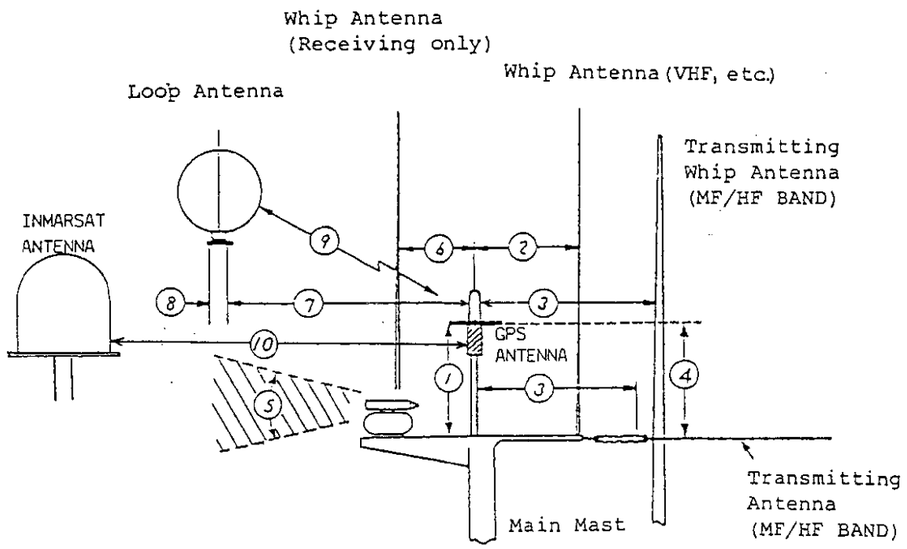
Micro wave is received from a GPS satellite!

If a funnel exists near the antenna for example, sight to a satellite with low elevation angle will be obstructed, resulting in long-lasting ACQ or INT condition.

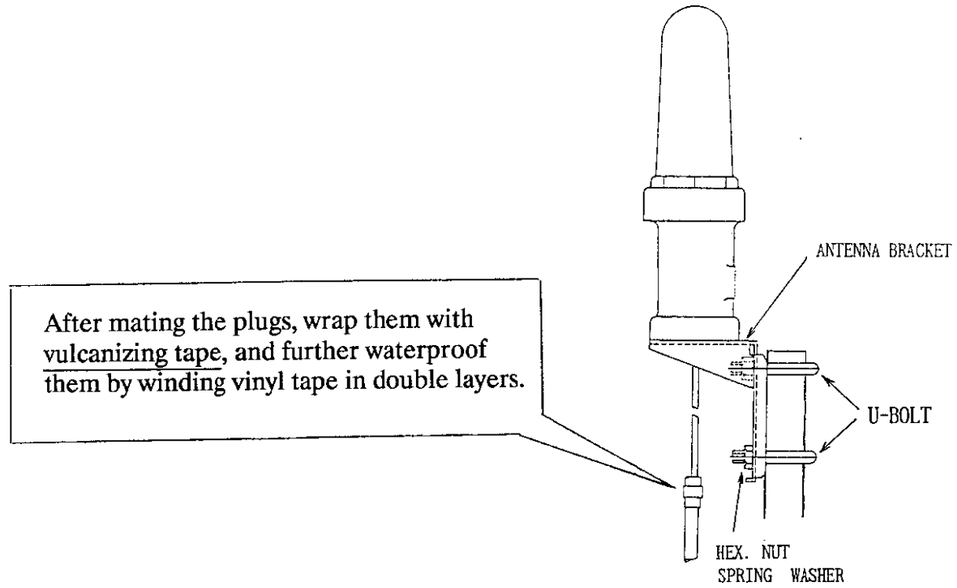
If the antenna surface is iced heavily due to sea water spray, etc., reception may be interfared. Locate the antenna where it will be free from sea water spray.

Mast-top mount offers best performance.

The following figure shows the requirements of minimum distances from other antennas. (These requirements are the same as the ones for a satnav antenna.)



① More than 0.5m
② More than 1m (more than 2m preferable)
③ More than 4m
④ More than 1.5m
⑤ Do not place in the radar beam (usually 30 to 40°)
⑥ More than 1m
⑦ Distance depends on the diameter of the steel pole ⑧
More than 1.5m if ⑧≤ 10cm
More than 3m if ⑧≥ 30cm
⑨ More than 3m
⑩ More than 5m



After mating the plugs, wrap them with vulcanizing tape, and further waterproof them by winding vinyl tape in double layers.

NOTE: Antenna mounting method for the U.S. export version is available on page D-3'.

DISPLAY UNIT

1. Avoid the following places.

   - A place exposed to direct sunlight
   - A place exposed to water splash, rain, etc.

   NOTE: Although the GP-500 is designed to be splash-proof structure, the above-mentioned places should be carefully avoided. If water splash or rain is unavoidable, enclose the unit in a cabinet and well protect the ANTENNA and DATA IN/OUT connectors by taping them.

   - A place exposed to direct air from an air-conditioner
   - A place with strong vibration
   - High-temperature, poorly-ventilated environment

2. Tabletop and bulkhead mountings are available by using the hanger bracket supplied. Flush mount kit OP03-21 (page D-2) is optionally available.

3. Notes on grounding

   As the GP-500 handles pulse signals, it may cause noise interference to adjacent equipment (ADF, radiotelephone, etc.) unless they are grounded properly. The recommended method is:

   - Mount the display unit away from radio equipment as far as possible.
   - Do not lay the antenna cable together with other cables.
   - All cables should be as short as possible. (But, leave enough slack in cables for future servicing.)
   - It is always a good idea to run cables on the ship's ground bus and fix them at regular intervals with copper straps.
   - Ground the display unit to the ship's grounding bus, using the copper strap supplied.

Notes on CABLING

You will find seven connectors arranged on the rear panel. Thoroughly read the following notes on respective connectors, then carry out wiring, referring to the interconnection diagrams included at the end part of this manual.

General Notes

1. 5-meter long cable with 2 twisted pairs is connected to each LOG, GYRO, DATA OUT, and DATA IN connectors. The GP-500 end of this cable is factory-terminated with a plug, i.e., both two pairs of core leads are soldered to the plug.

   If only one pair of leads are used at the external equipment end, leave the unused pair open by insulating the leads individually with vinyl tape, etc. Do not ground the unused leads because signals may be output there from the GP-500.

2. If an external equipment is considerably distant from the GP-500, there will be a difference in ground voltage between the two places. This creates a current which flows through the armor or shielding mesh if it is grounded at both ends, resulting in noise induced to the core leads. Ground the armor or shielding mesh at one end only.

10-40V DC

Connect the power cable here.

The unit is shipped from the factory with a 3A fuse set in the fuse holder, and is ready to operate from 12/24V supply. For 32V operation, use the 2A fuse which is contained in the spare parts. The fuse holder is located on the rear panel.

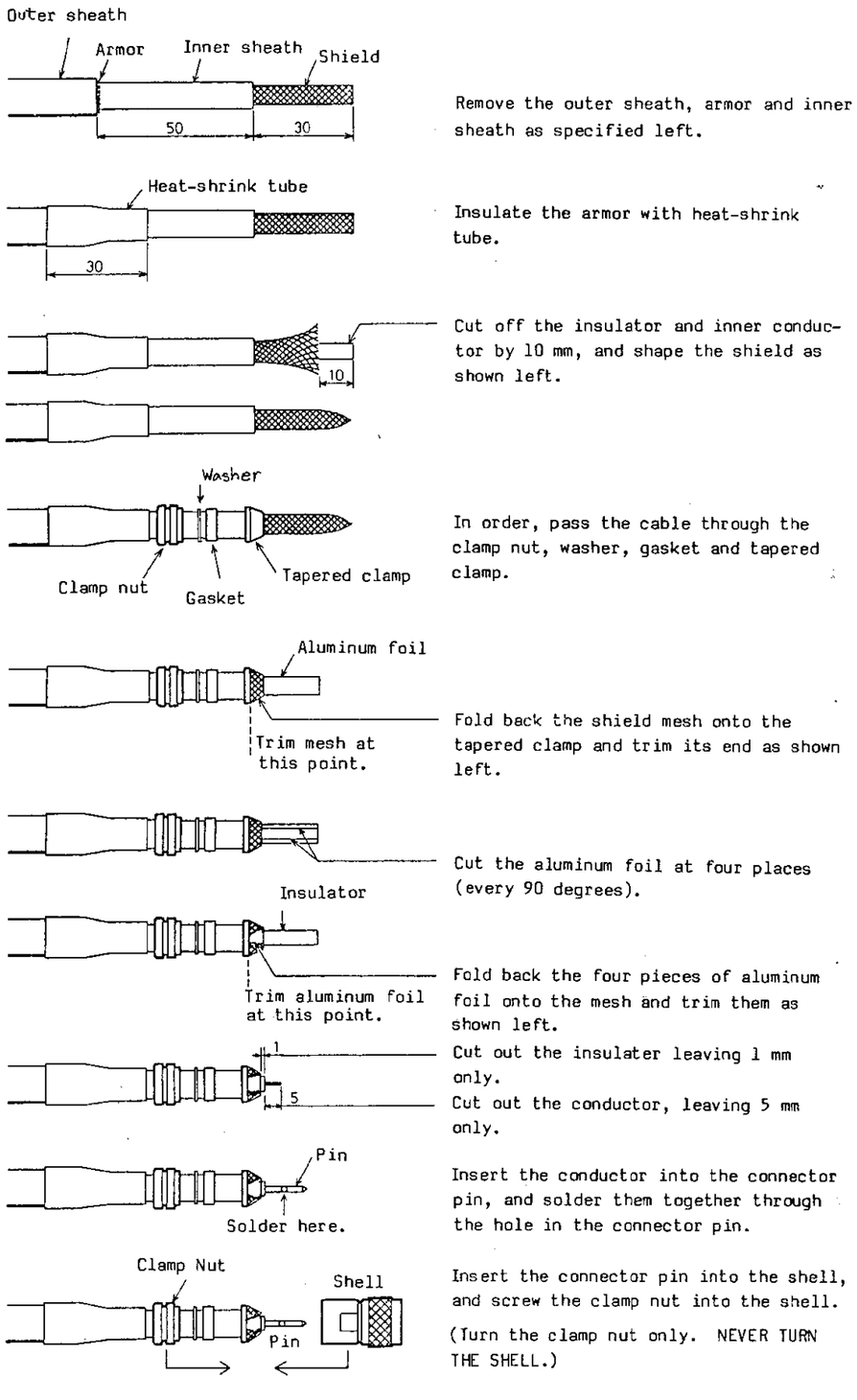
ANTENNA

Connect the antenna cable here. You may leave slack in the cable. If operation of the GP-500 causes noise/interference to other electronic equipment, however, cut off the unused length.

Optional 50m or 30m cable (8D-FBCV) can not be connected to the GP-500 directly because the diameter is too large for the GP-500 end connector. Cut the cable to the necessary length, solder a plug (supplied) to the cable end as instructed on the next page, then joint it to the 1m connector-conversion cable which comes with the 50m or 30m cable.

NOTE: For ANTENNA CABLE EQUIVALENCE, see page AP-17.

Fabricating the 30/50m Antenna Cable


Outer sheath
Armor
Inner sheath
Shield
50
30
Remove the outer sheath, armor and inner sheath as specified left.
Heat-shrink tube
30
Insulate the armor with heat-shrink tube.
10
Cut off the insulator and inner conductor by 10 mm, and shape the shield as shown left.
Washer
Clamp nut
Gasket
Tapered clamp
In order, pass the cable through the clamp nut, washer, gasket and tapered clamp.
Aluminum foil
Trim mesh at this point.
Fold back the shield mesh onto the tapered clamp and trim its end as shown left.
Cut the aluminum foil at four places (every 90 degrees).
Insulator
Trim aluminum foil at this point.
Fold back the four pieces of aluminum foil onto the mesh and trim them as shown left.
1
5
Cut out the insulater leaving 1 mm only.
Cut out the conductor, leaving 5 mm only.
Pin
Solder here.
Insert the conductor into the connector pin, and solder them together through the hole in the connector pin.
Clamp Nut
Shell
Pin
Insert the connector pin into the shell, and screw the clamp nut into the shell.
(Turn the clamp nut only. NEVER TURN THE SHELL.)

LOG (Ref. Page M-22.)

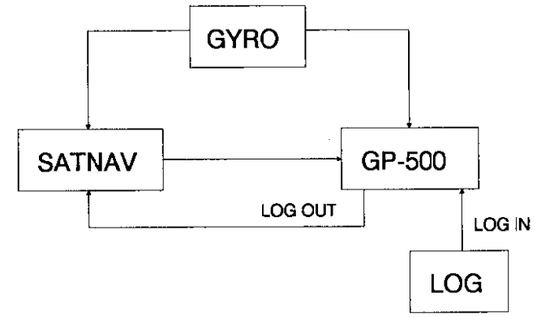
Connect a speed log here. TTL level or contact closure signal with wide range of pulses/mile ratio is acceptable.

*NOTE: 1. NMEA 0183 data (**VHW) entered through the DATA IN or DATA IN/OUT connector may be used as speed information instead of the speed log signal.*

2. Contact closure signal output representing ship's speed is available on this connector. This output is not the bypassed log signal input, but is generated by the GP-500 in accordance with the speed data which is obtained by GPS-reception or back-up navaid. Ratings of the relay contact are as follows.

	Resistance Load (cosø = 1)	Inductance Load (cosø = 0.4, L/R = 7ms)
Rating	125Vac 0.4A 30Vdc 2.0A	125Vac 0.2A 30Vdc 1.0A

When you use a satnav as a back-up navaid for the GP-500, you should connect log/gyro to the satnav for its dead reckoning. In this case you would connect the log/gyro to the GP-500 as well, so that you may use the GPDR mode when the satnav (NNDR) is faulty. The following connection appears to work without a problem, but in reality it doesn't.



When the NNDR mode is used, the GP-500 produces the LOG OUT signal based on the speed information from the SATNAV. The SATNAV calculates that speed information based on the LOG OUT. This results in an endless loop. The log signal for the SATNAV should be fed from the LOG, not from the GP-500.

GYRO (Ref. Page M-22.)

Connect a heading sensor (Gyrocompass + AD10S) here.

NOTE: *NMEA 0183 data (**VHW) entered through the DATA IN or DATA IN/OUT connector may be used as heading information instead of the gyro data.*

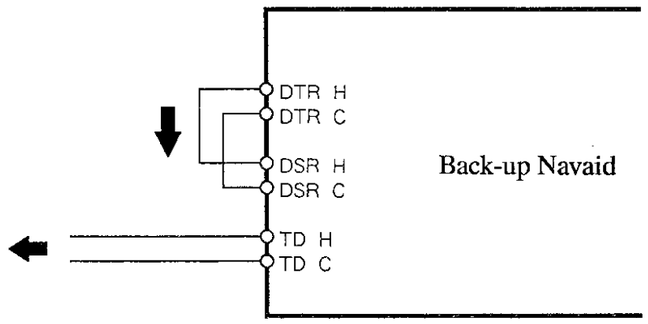
DATA IN (Ref. Page M-25.)

Connect a back-up navaid (FURUNO CIF or NMEA 0183 format) here.

NOTE: 1. The back-up navaid with the NMEA 0183 output may be tied to the DATA IN/OUT connector as well.

For a few seconds after the power is turned on, the GP-500 receives data from both DATA IN and DATA IN/OUT connectors. If data are received from DATA IN, the GP-500 receives data from DATA IN only thereafter, totally desregarding the input from DATA IN/OUT. If not, the GP-500 receives data from DATA IN/OUT only.

2. If a DSR input is required at the back-up navaid, tie it to the own DTR output. Other wise, the back-up navaid will not transmit.



3. Although this connector is named " DATA IN," an output for a autopilot is available on this connector. As DATA IN Pin #1 and #2 are internally tied to DATA OUT Pin #3 and #4, you may connect an autopilot to either connector.

DATA OUT (Ref. Page M-26)

Connect an external equipment (display device) with FURUNO CIF or NMEA 0183 input. An autopilot (NMEA 0180 or NMEA 0183) may also be connected.

NOTE: 1. An equipment with NMEA 0183 may be connected to the DATA IN/OUT connector as well.

2. The output for an autopilot is available on DATA OUT pin #3 and #4. As these pins are internally tied to DATA IN Pin #1 and #2, you may connect an autopilot to either connector.

DATA IN/OUT (Ref. Page M-28)

- An external equipment (display device) with the NMEA 0183 input may be connected.

  NOTE: Leave the NMEA-RD H and NMEA-RD C lines open at the GP-500 end.

- A back-up navaid with the NMEA 0183 output may be connected.

  NOTE: If a DSR input is required at the back-up navaid side, tie it to the own DTR output.

- A personal computer, etc. with the RS232C interface may be connected.

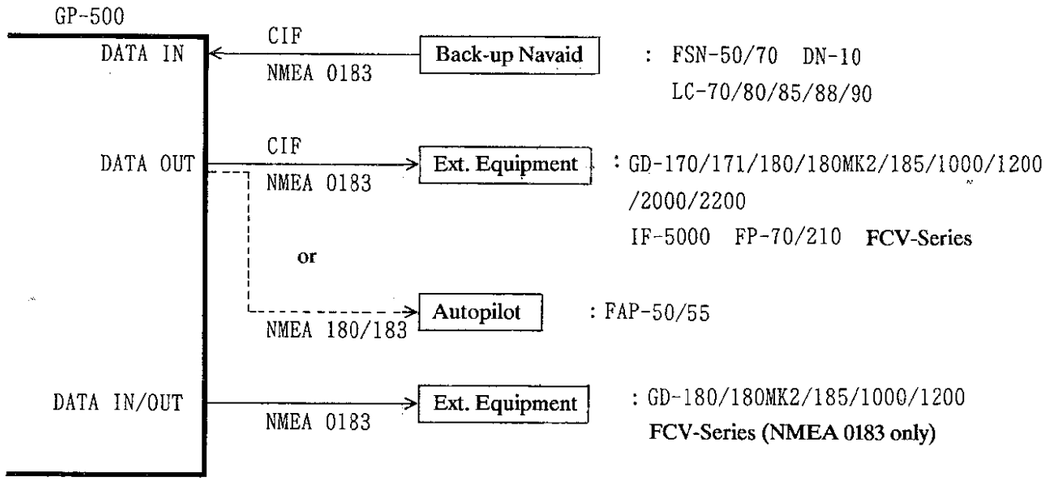
  NOTE: NMEA 0183 data are output with RS232C signal level. A data handling program for the computer should be prepared by the user.

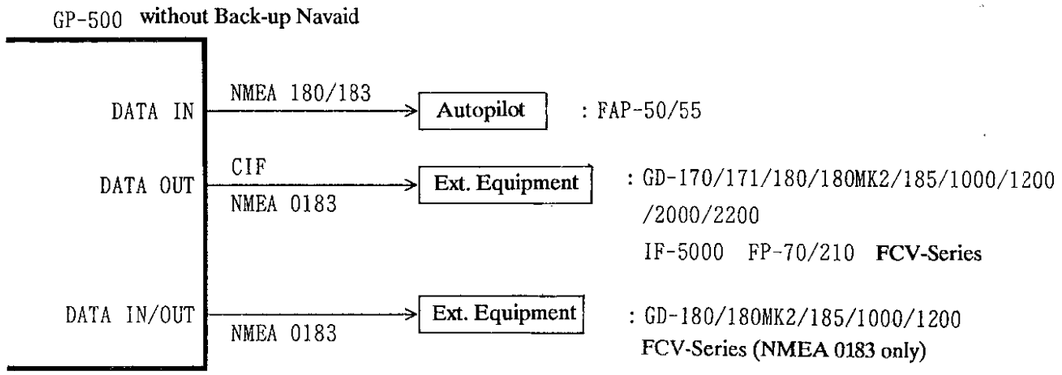
- An external buzzer may be connected.

  Contact closure signal is output, and you may connect a horn for a car, etc. The ratings for the relay contact are same as the one shown on page AP-13 [LOG].

- 1Hz clock signal output is available for ship's clock, etc. The electrical characteristic is equivalent to the NMEA standard.

Example of Connector Assignment



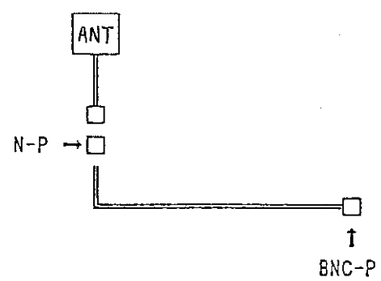


Antenna Cable Equivalence

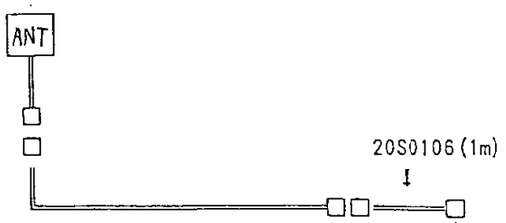
Depending on the cable type, the maximum allowable length, configuration, and plugs vary as tabulated below.

Cable		Config.	Plugs			Note
Type	Max. Length		[Code]	Type	Q'ty	
3D-2V 3D-QEV 3D-XV	15 m	(A)	[000-501-510] [000-112-144]	N-P-3 BNC-P117NI	1 1	
5D-2V	25 m	(B)	[000-501-510]	N-P-3 BNC275-P	1 1	
RG-8/U	30 m	(B)		UG-21D/U	2	Plug converter cable assy. required. [000-117-602] 20S0106 (1 m)
8D-2V	35 m	(B)	[000-501-512]	N-P-8	2	
5D-FB	45 m	(B)	[000-107-861]	N-P-5	2	
8D-FB	65 m	(B)	[000-111-549]	N-P-8DFB	2	
10D-FB	83 m	(B)	[000-501-517]	N-P-10	2	

(A)

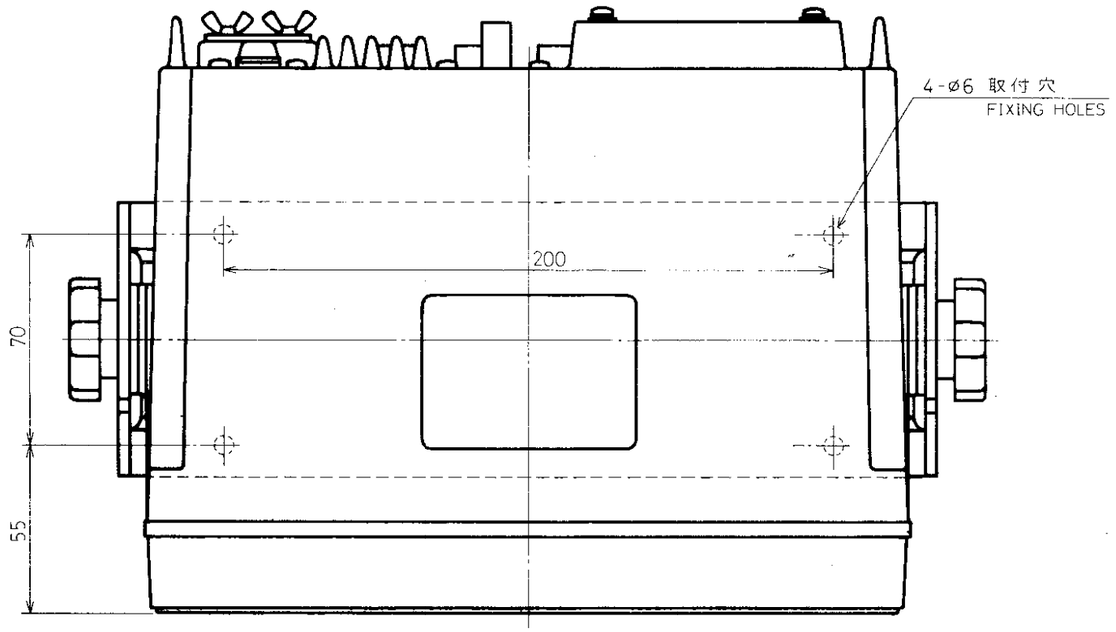


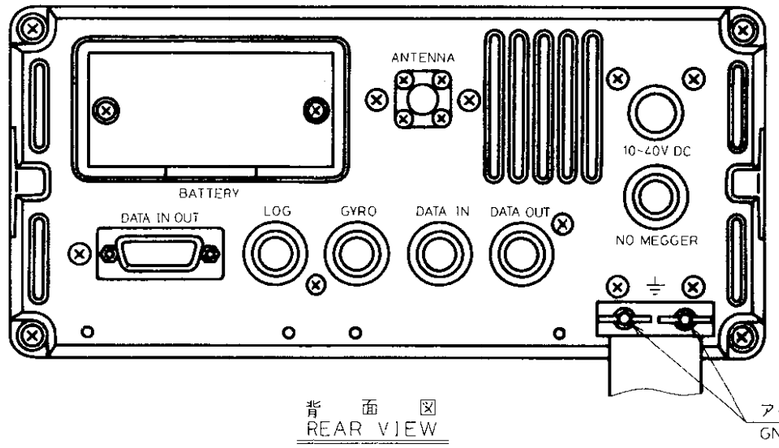
(B)



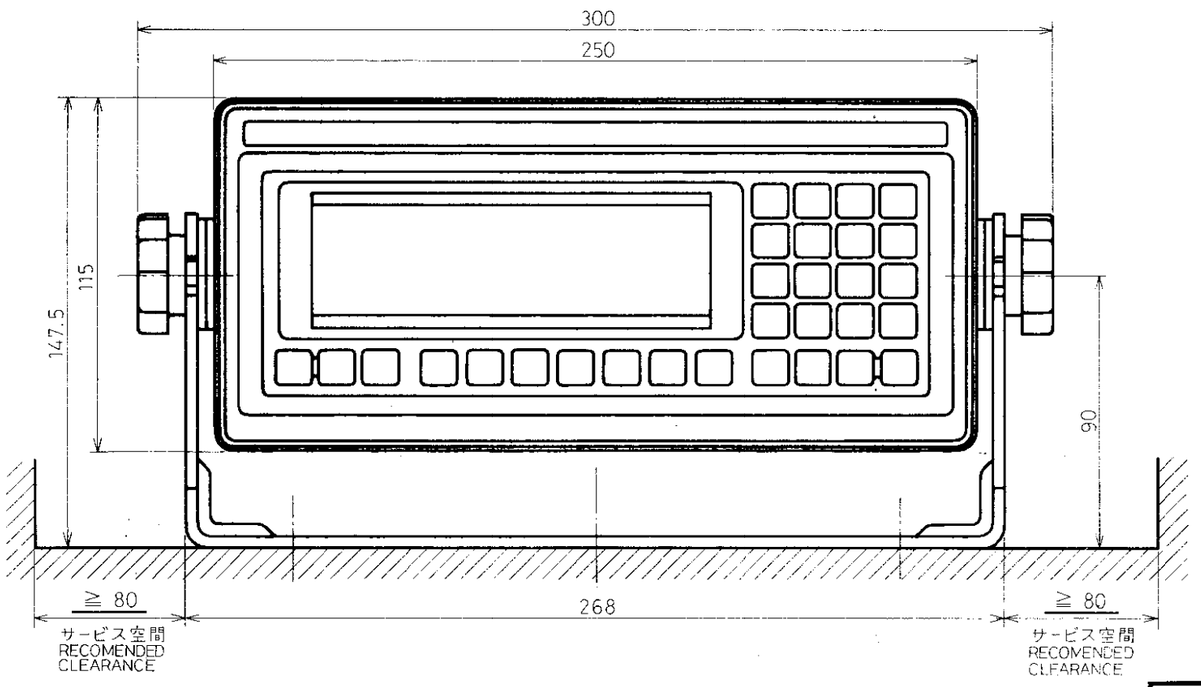
FURUNO

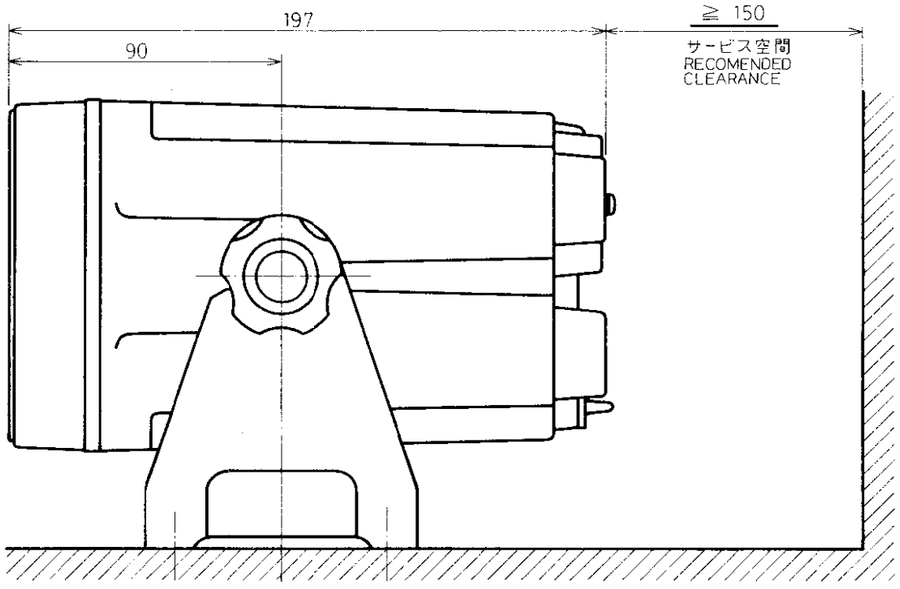
D - 1





背　面　図
REAR VIEW





品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	JUL・26・'89 T. NAKAJO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	受信演算部外寸図 MAIN UNIT
検図 CHECKED	JUL・26・'89 T. YUYAMA	尺度 SCALE	1/2	GP-500	
製図 DRAWN	JUL・25・'89 U. SAITO	重量 WEIGHT	4 kg	図番 DWG.NO.	C4312-G01-A

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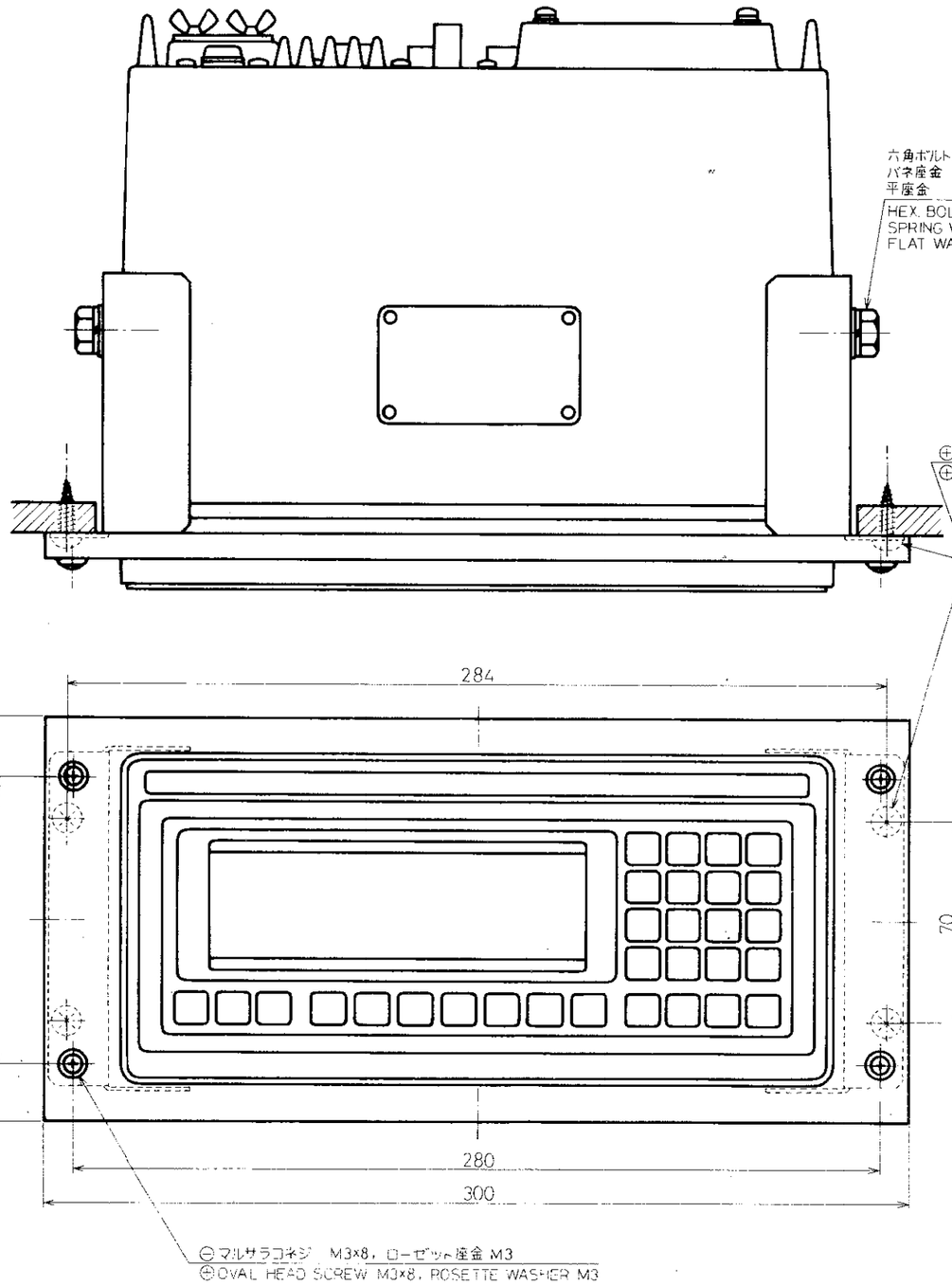
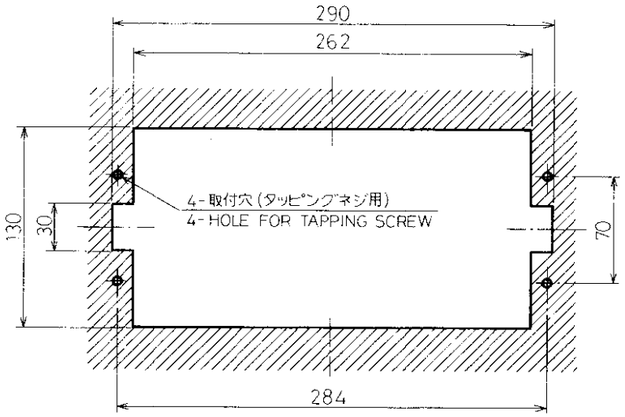
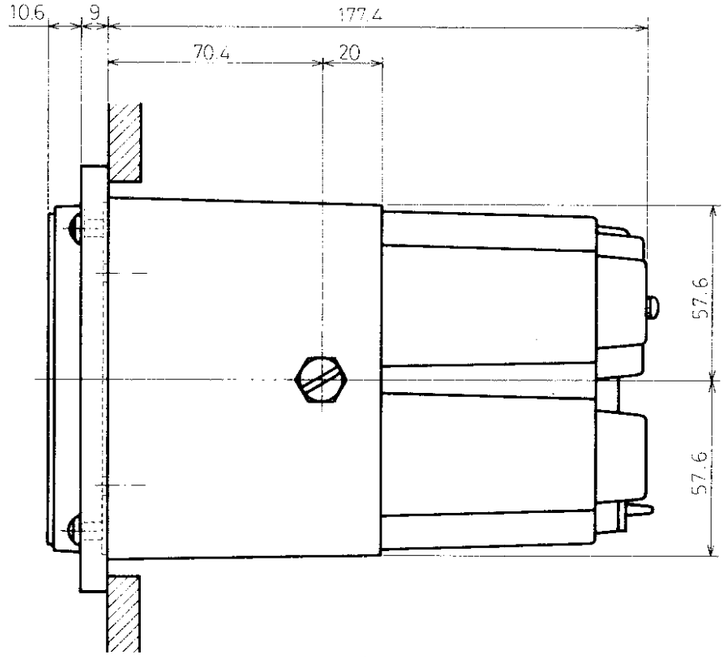
FURUNO

D－2





壁取付穴詳細 SIZE OF CUTOUT



品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	NOV・6・89 T. NAKAJO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	フラッシュマウント外寸図
検図 CHECKED	NOV・6・89 T. YUYAMA	尺度 SCALE	1/2	GP-500	FLUSH MOUNT (OP20-1)
製図 DRAWN	NOV・6・89 M. [illegible]	重量 WEIGHT	4.1 kg	図番 DWG.NO.	C4312-G02-A

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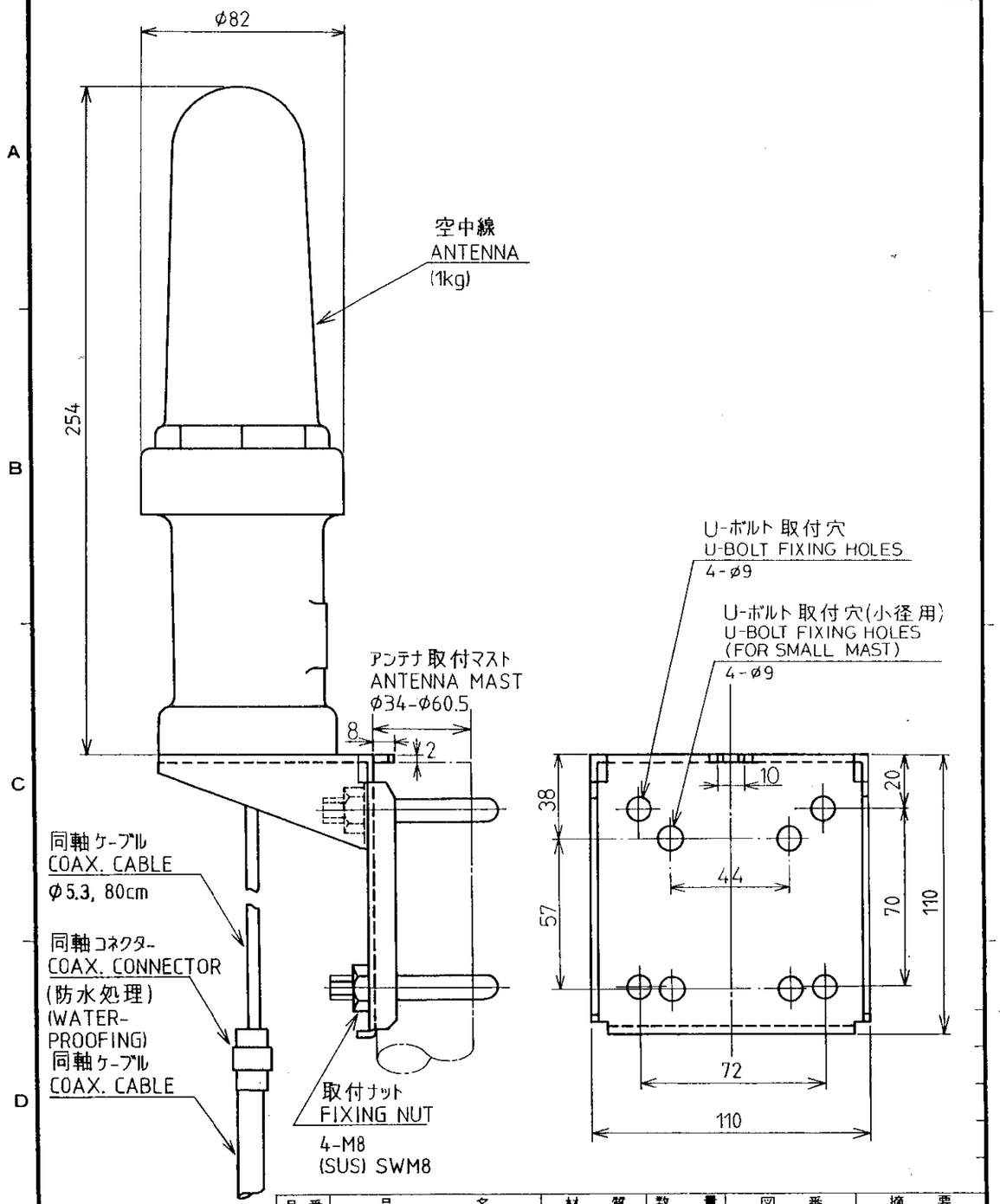
FURUNO

D - 3



品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	DEC・18・'87 T.NAKAGO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	空中線部外観図
検図 CHECKED	Dec・18・'87 I.AMANO	尺度 SCALE	1/2	GP-300/500	ANTENNA UNIT (GPA-012)
製図 DRAWN	DEC・18・'87 T.YUYAMA	重量 WEIGHT	1.7 kg	図番 DWG.NO.	C4313-014-G

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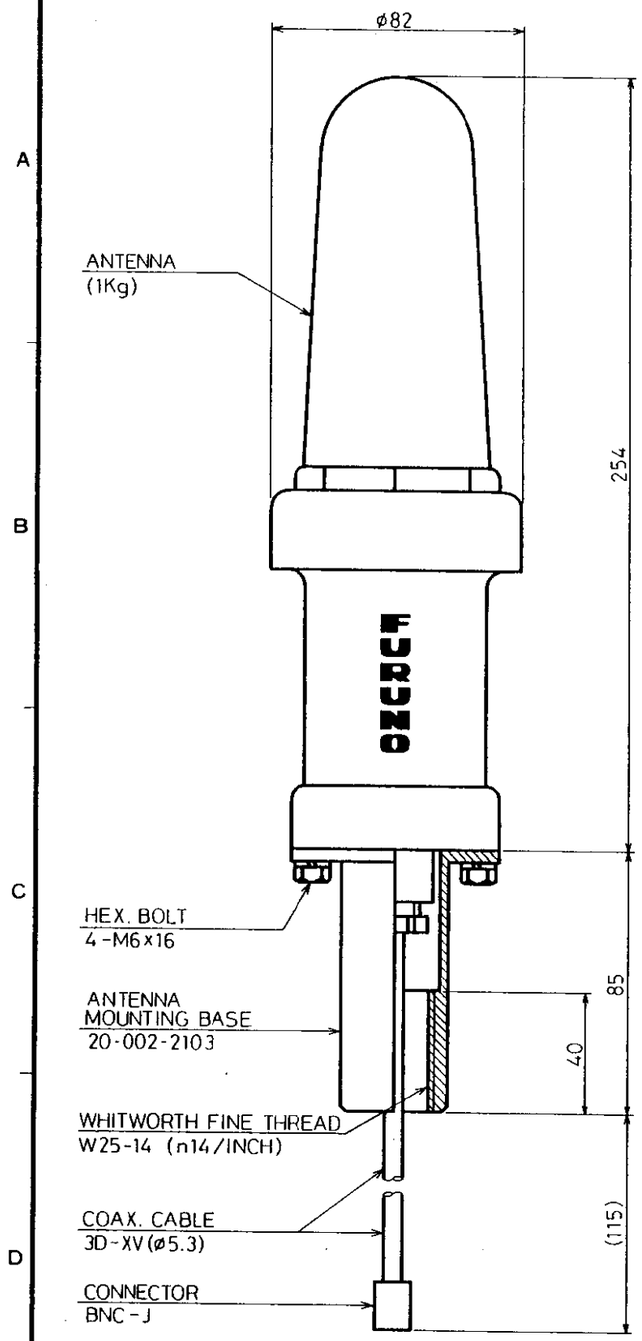
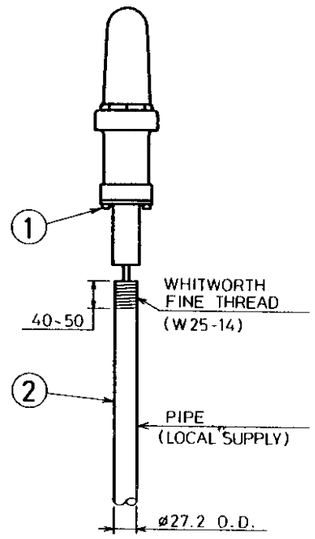
FURUNO

D - 3a



MOUNTING PROCEDURE



① FIX WITH FOUR BOLTS.

② SCREW IN.

For USA Version

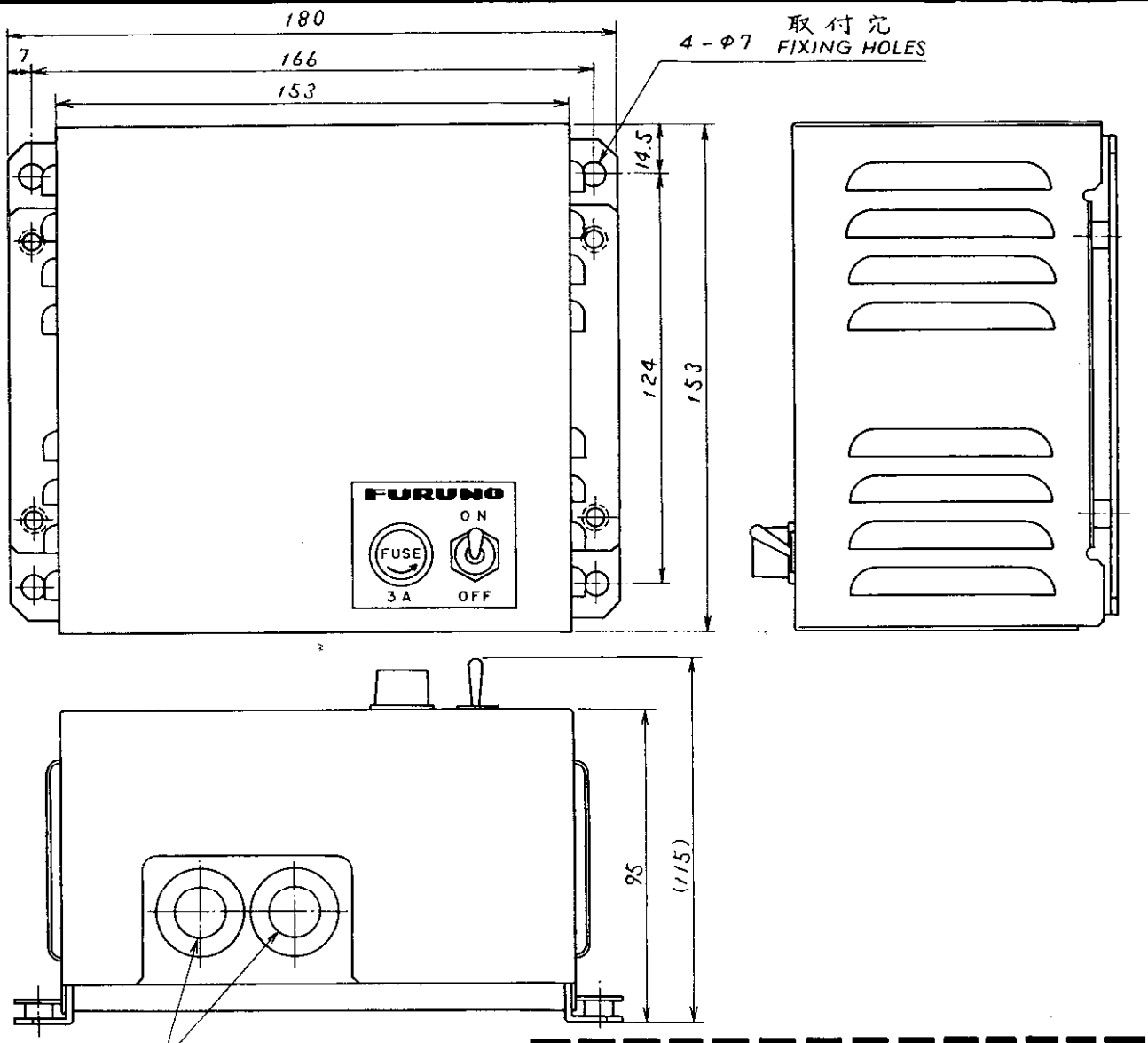
品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

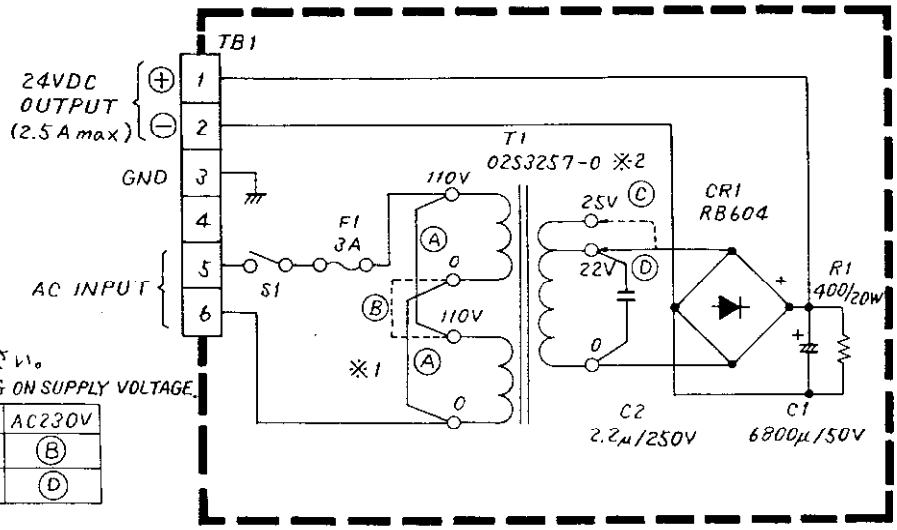
承認 APPROVED	JAN・20・'90 T.NAKAGO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	空中線外観図
検図 CHECKED	JAN・19・'90 T.YUYAMA	尺度 SCALE	1/2	GP-500	ANTENNA UNIT (GPA-012-F)
製図 DRAWN	JAN・19・'90 N.SAITO	重量 WEIGHT	1.4 kg	図番 DWG.NO.	C4312-G03-B

FURUNO ELECTRIC CO., LTD.

FURUNO

D－4





入力電圧に応じて接続を変更して下さい。
CHANGE TAP CONNECTIONS DEPENDING ON SUPPLY VOLTAGE.

	AC100V	AC110V	AC220V	AC230V
※1	Ⓐ	Ⓐ	Ⓑ	Ⓑ
※2	Ⓒ	Ⓓ	Ⓓ	Ⓓ

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	JUN.14.'89	三角法 THIRD ANGLE PROJECTION	名称 TITLE: PR-62 整流器外観図 RECTIFIER UNIT
検図 CHECKED		尺度 SCALE: 1/2	
製図 DRAWN		重量 WEIGHT: 3 kg	図番 DWG.NO. C5003-034-B

FURUNO ELECTRIC CO., LTD.

FURUNO

S-1

GPA-012
空中線部
ANTENNA UNIT

*2←(15m : N-P-3,30/50m : N-P-8DFB)
8D-FBCV *50M* 14.3mmφ 50m (N-P-8DFB)
8D-FBCV *30M* 14.3mmφ 30m (N-P-8DFB)
3D-XV *15M* 5.3mmφ 15m
(N-J-3) *2
3D-XV 1m, 5.3mmφ
3D-XV 1m, 5.3mmφ
*2 (BNC-P-3)

GPR-013
受信演算部
DISPLAY UNIT

ANTENNA
1
2

スピードログ SPEED LOG
F. GND

外部機器 EXT. EQUIPMENT
F. GND

接点信号又はTTLレベル信号入力
CONTACT CLOSURE or TTL LEVEL SIG. IN
接点信号出力
CONTACT CLOSURE SIG. OUT

LOG
*2 *3
EV-SA7/0.16×2P (5m, 6.0mmφ)

シロ	WHT	1	LOG-SIG
クロ	BLK	2	LOG-SIG GND
キ	YEL	3	LOG-CNT OUT
ミドリ	GRN	4	LOG-CNT OUT
		5	N.C.
		6	F. GND

AD コンバーター AD CONV. AD-10/10S
B1TB1
10
9
8
7

潮流計 CURRENT IND, CI-30 (CI-310)
J208
DE9P
半田面 SOLDER SIDE

(5m, 6.0mmφ) EV-SA7/0.16×2P
*2 *3
GYRO

1	シロ	WHT	1	GYRO-RD H
2	クロ	BLK	2	GYRO-RD C
3	キ	YEL	3	GYRO-CLK H
4	ミドリ	GRN	4	GYRO-CLK C
9			5	N.C.
			6	F. GND

整流器 RECTIFIER PR-62 (60W)
5 6 1 2 (+ −)

船内電源
SHIP'S MAINS
100/110/220V
50-60Hz, 1φ, 26VA
10-40Vdc 18W
*1 DPYC-1.25
22S0019 *3M* 6.0mmφ 3m
*2 (MJ-A2SRM)
10-40VDC

シロ	WHT	1 ⊕
クロ	BLK	2 ⊖

アース銅板 COPPER STRAP

DATA OUT
*2 *3
(5m, 6.0mmφ) EV-SA7/0.16×2P

NMEA/CIFC-TD H	1	シロ	WHT	
NMEA/CIFC-TD C	2	クロ	BLK	
AP-TD H	3	キ	YEL	
AP-TD C	4	ミドリ	GRN	
N.C.	5			
F. GND	6			

DATA IN
*2 *3

	1	シロ	WHT	
	2	クロ	BLK	
NMEA/CIFS-RD H	3	キ	YEL	
NMEA/CIFS-RD C	4	ミドリ	GRN	
N.C.	5			
F. GND	6			

EV-SA7/0.16×2P (5m, 6.0mmφ)

DATA IN/OUT
(XM2A-1501) 8 7 2 1 / 15 9
フード HOOD XM2S-1513
半田面 SOLDERING SIDE

F. GND	1			
RS-TD	2			
RS-RD	3			
RS-DTR	6			
RS-SIG GND	8			
ALM-OUT	4	チャ	BRN	
ALM-OUT	5	アカ	RED	

CO-SPEVV-SB-C 0.2SQ×1P

F. GND	9			
NMEA-TD H	10	チャ	BRN	
NMEA-TD C	11	アカ	RED	
NMEA-RD H	12	キ	YEL	
NMEA-RD C	13	ダイ	ORG	

CO-SPEVV-SB-C 0.2SQ×2P

1Hz CLOCK OUT

SEC H	14	チャ	BRN	
SEC C	15	アカ	RED	

CO-SPEVV-SB-C 0.2SQ×1P

NMEA 0183/FURUNO CIF
RD-H
RD-C
F. GND
外部機器 EXT. EQUIPMENT
GD-170/171/180/180 MK-2/185/1000/1200/2000/2200
IF-5000 FP-70/210 FCV-SERIES

NMEA 0180/0183
RD H
RD C
F. GND
オートパイロット AUTOPILOT
FAP-50/55

NMEA 0183/FURUNO CIF
DTR H
DTR C
DSR H
DSR C
TD H
TD C
F. GND
バックアップ航法 BACK-UP NAVAID
FSN-50/70 DN-10
LC-70/80/85/88/90
DSRがあればDTRにつないでおくこと。
COUPLE DTR TO DSR IF PROVIDED.

RS232C (FORMAT : NMEA 0183)
パーソナルコンピューター等
PERSONAL COMPUTER, etc.

接点信号 CONTACT CLOSURE SIG.
F. GND
外部ブザー EXT. BUZZER

NMEA 0183
DTR H
DTR C
DSR H
DSR C
RD H
RD C
TD H
TD C
F. GND
バックアップ航法 BACK-UP NAVAID
LP-1000/1200/1300
LC-88/90 FSN-50
DSRがあればDTRにつないでおくこと。
COUPLE DTR TO DSR IF PROVIDED.
外部機器 EXT. EQUIPMENT
(TD ---► NO CONNECTION) (TDはオープンにしておく)
GD-180/180 MK-2/185/1000/1200 FAP-50/55
FCV-SERIES WITH NMEA 0183 INPUT.

外部機器(時計等) EXT. EQUIPMENT (CLOCK, etc.)
F. GND

注意 *1 造船所支給。 *2 出荷時プラグ接続済。
*3 プラグはすべてMJ-A6SPF。ケーブルの未使用線は個別にテーピング.

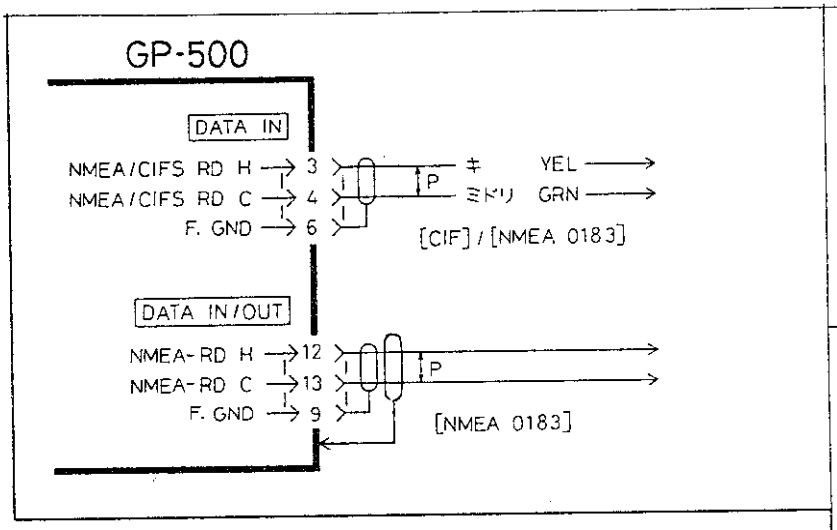
NOTE *1 SHIPYARD SUPPLY. *2 PLUG IS FACTORY-SOLDERED.
*3 ALL PLUGS ARE MJ-A6SPF. UNUSED CORE LEADS MUST BE ISOLATED INDIVIDUALLY. DO NOT GROUND THEM.

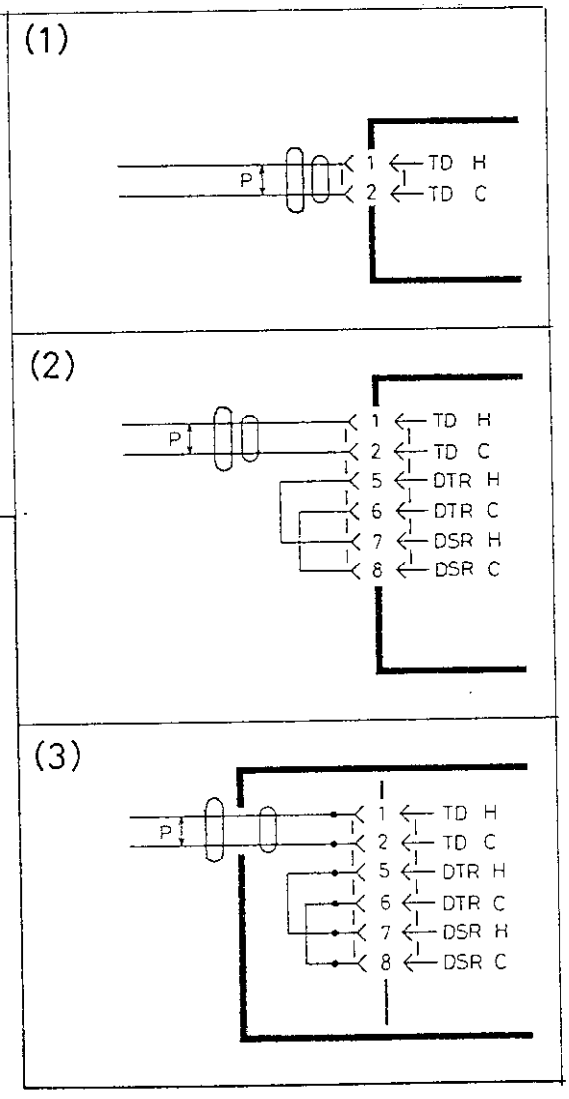
承認 APPROVED	NOV・22・'89 T. NAKANO	名称 TITLE	GP-500 相互結線図 INTERCONNECTION DIAGRAM
検図 CHECKED	NOV・22・'89 M. SAITO		
製図 DRAWN	NOV・22・'89 T. YUYAMA	図番 DWG. NO.	C4312-C01-C

FURUNO ELECTRIC CO., LTD.

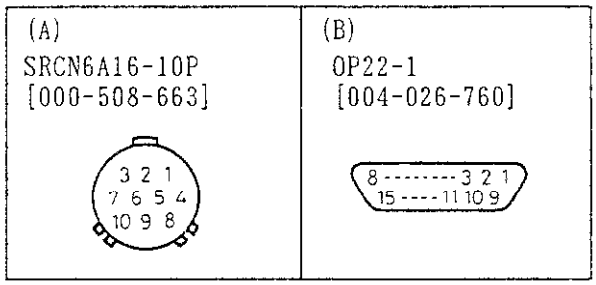
Connection of BACK-UP NAVAID

Back-up Navaid						Note
Model	Port to be used		Format available		Connection	
	Name	Plug	CIF	NMEA 0183		
FSN-50	J402	NH		o	(1)	
	J403	NH	o		(1)	
FSN-70	CIF-A, B, C (J4, 5, 6)	NH	o		(3)	
LC-70	GPIF	(A)	o		(2)	
LC-80/85	DATA OUT1	(A)	o		(1)	
LC-88/90	OUTPUT	(A)	o	o	(1)	
DN-10	CIF	(A)	o		(1)	
LP-1000 LP-1200 LP-1300	OUTPUT	(B)	o	o	(1)	Strap a jumper between Pin #13 (OPST) and Pin #14 (GND).
IF-5000	J3, 4, 7	NH	o		(3)	



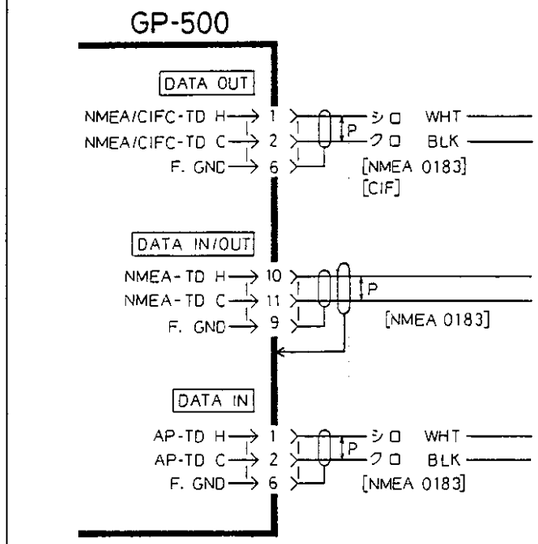


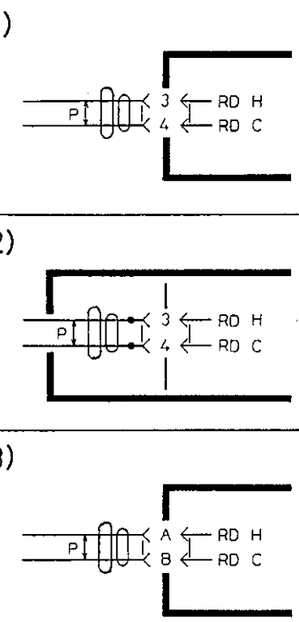
PLUG (SOLDERING SIDE)



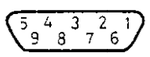
Connection of EXTERNAL (DISPLAY) EQUIPMENT

External (Display) Equipment						
Model	Port to be used		Format available		Connection	Note
	Name	Plug	CIF	NMEA 0183		
GD-170/171	GPIF	(A)	o		(1)	
GD-180	CIF IN		o		(3)	Plug: PRC03-12A10-3AM10.5 [000-110-678]
	CN1	(A)	o	o	(1)	
	CIF IN/OUT	(A)	o		(1)	
GD-180 MK-2	CIF IN		o	o	(3)	Plug: PRC03-12A10-3AM10.5 [000-110-678]
	CN1	(A)	o	o	(1)	
	CIF IN/OUT	(A)	o	o	(1)	
GD-1000 GD-1200 LP-1000 LP-1200 LP-1300	EXT NAV	(B)	o	o	(1)	Strap a jumper between Pin #7 (EPST) and Pin #8 (GND).
GD-2000 GD-2200	NAV	NH	o		(2)	
IF-5000	J1	NH	o		(2)	
	J2	NH	o		(2)	
FP-70	J2	NH	o		(2)	
FP-210	CIF	(A)	o		(1)	



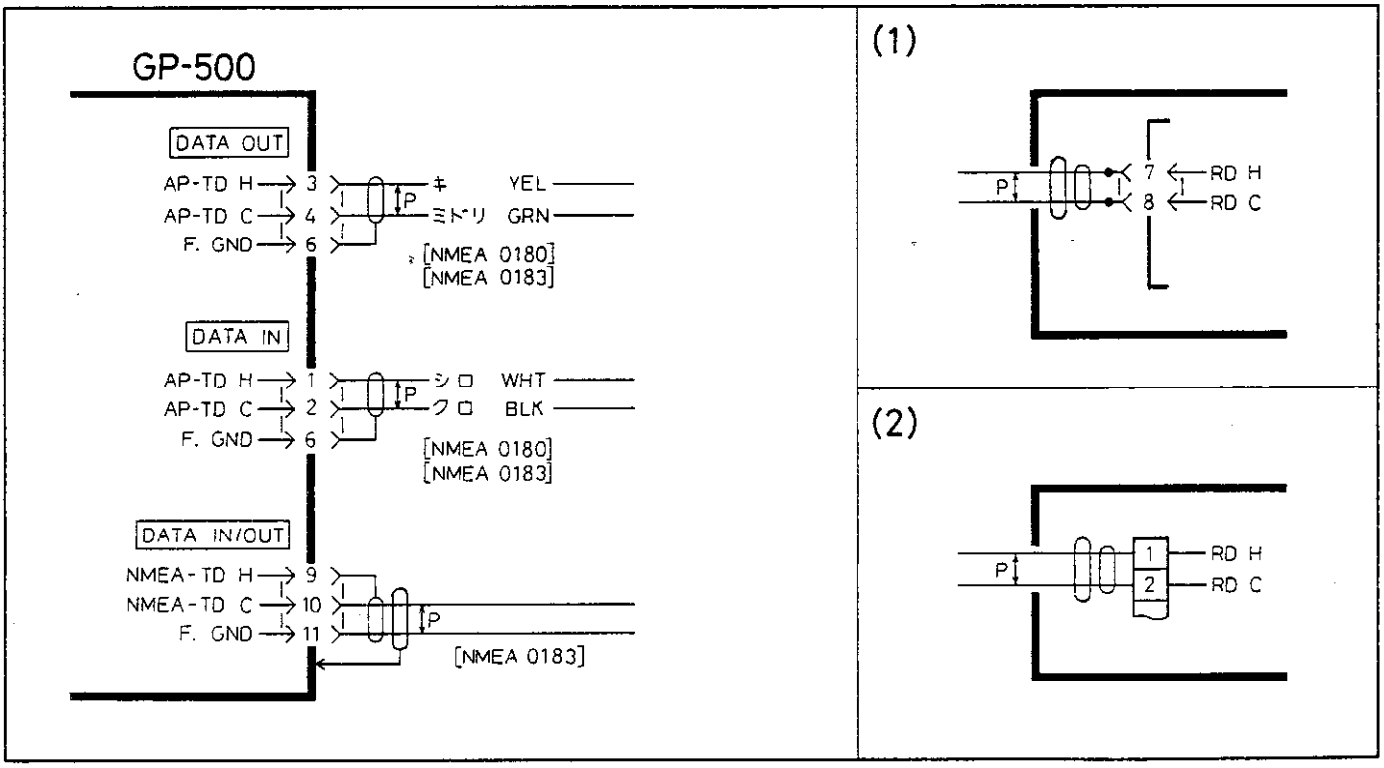


PLUG (SOLDERING SIDE)

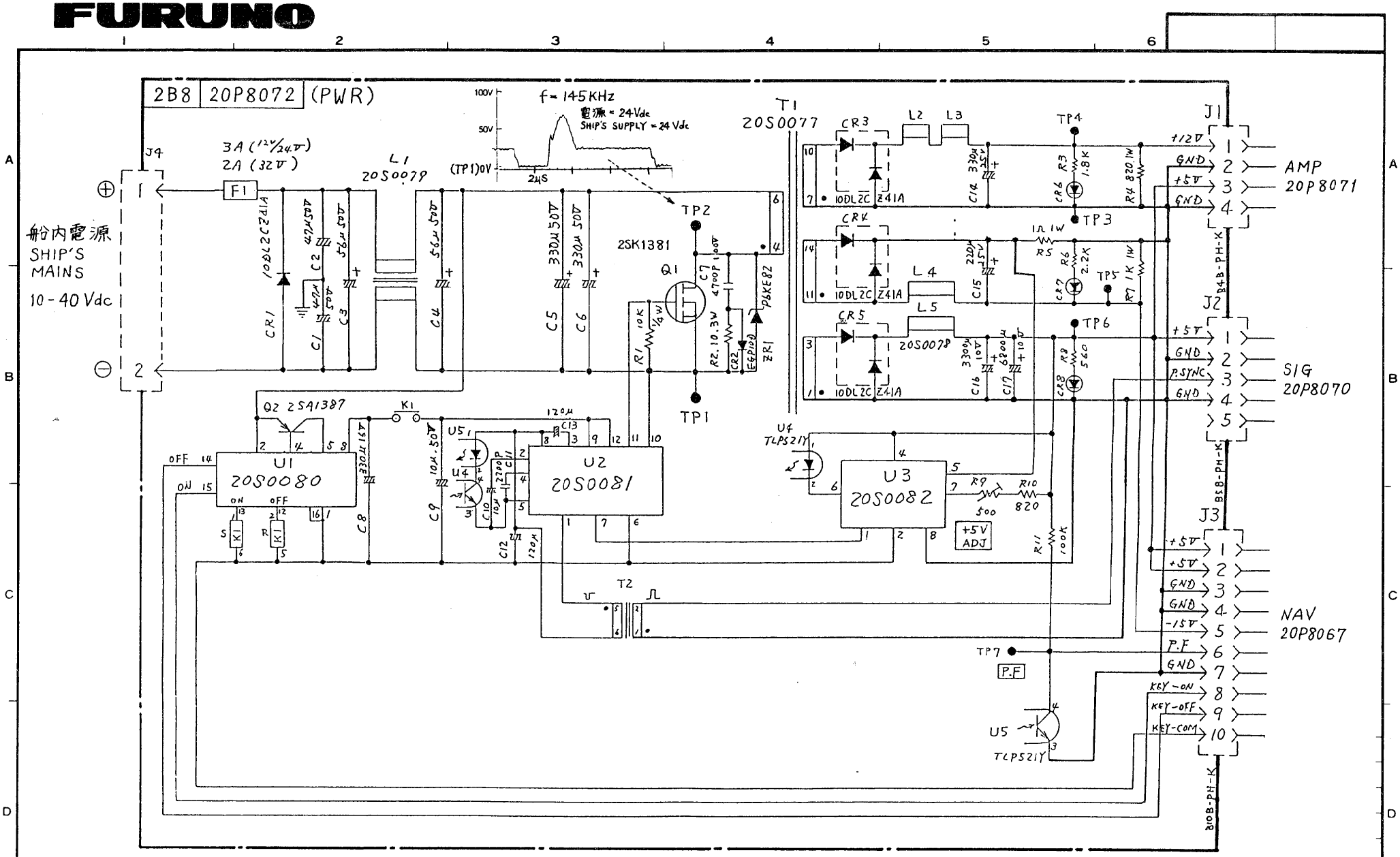
(A)	(B)
SRCN6A16-10P [000-508-663]	0P22-2 [004-026-770]
	

Connection of AUTOPILOT

Autopilot						Note
Model	Port to be used		Format available		Connection	
	Name	Plug	NMEA 0180	0183		
FAP-50	J6	NH	o	o	(1)	
FAP-55	TB2 NMEA		o	o	(2)	



FURUNO



承認 APPROVED	NOV. 8 '89 T.WAKAUO	名称 TITLE	PWR基板 PWR BOARD
検図 CHECKED	NOV. 8 '89 N. SAITO	20P8072	
製図 DRAWN	NOV. 8 '89 T. YUYAMA	図番 DWG. NO.	C4312-K01-A

GP-500

FURUNO ELECTRIC CO., LTD.

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